# Process Improvement via CMMI

**Presented by: OST, Inc.**

**November 17th, 2011**

OST®

CMMI LEVEL 5 | ISO 9001:2008

# Agenda

- **Case Study I**: Use CAR to reduce the time taken to close critical defects
- **Case Study II**: Use QPM to dynamically manage our program to optimize expected project objectives
- Questions

# Case Study - I

Using CAR to reduce the time taken to close critical defects

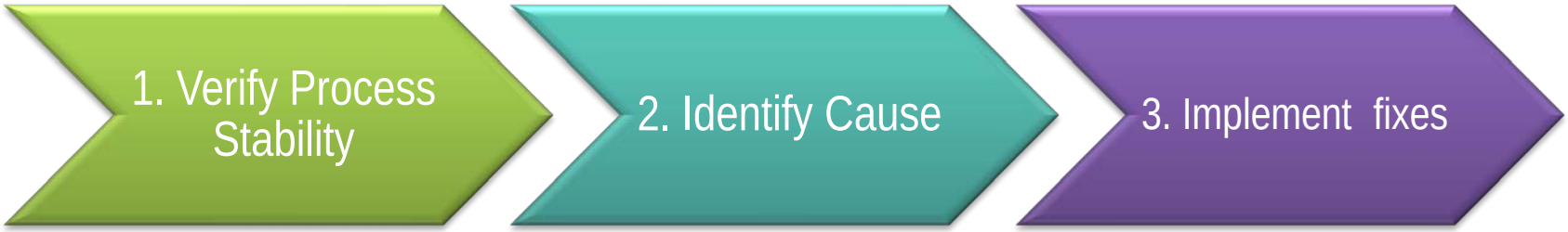
# Background

- Mission critical project
- Major release involving complete re-write of 350,000 lines of code
- Process already in place for system testing and logging of defects
- Data Source – Mercury Quality Center
- Daily review of defects opened, fixed, tested and closed

# GOAL: Why do a CAR

- Reduce the mean and standard deviation for the time taken to close critical defects
- Identify the root causes that contribute to high mean and variance to close critical defects

# METHOD: Root Cause Analysis Steps




- Use I-MR charts to identify outliers and cause

- Repeat steps 2 & 3 for each identified phase for the process till all root causes are resolved

# TOOLS: One-way ANOVA

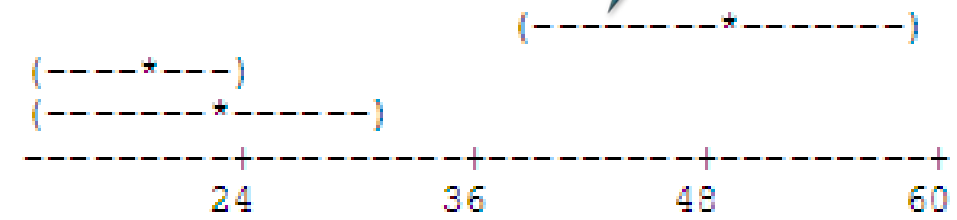
## One-way ANOVA: Days to close versus Severity

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Severity | 2 | 14300 | 7150 | 14.01 | 0.000 |
| Error | 112 | 57156 | 510 | | |
| Total | 114 | 71456 | | | |

S = 22.59  R-Sq = 20.01%  R-Sq(adj) = 18.58%

| Level | N | Mean | StDev |
|---|---|---|---|
| Critical | 20 | 48.85 | 33.97 |
| Major | 72 | 18.79 | 16.22 |
| Minor | 23 | 22.39 | 27.43 |

Individual 95% CIs For Mean Based on Pooled StDev




Pooled StDev = 22.59

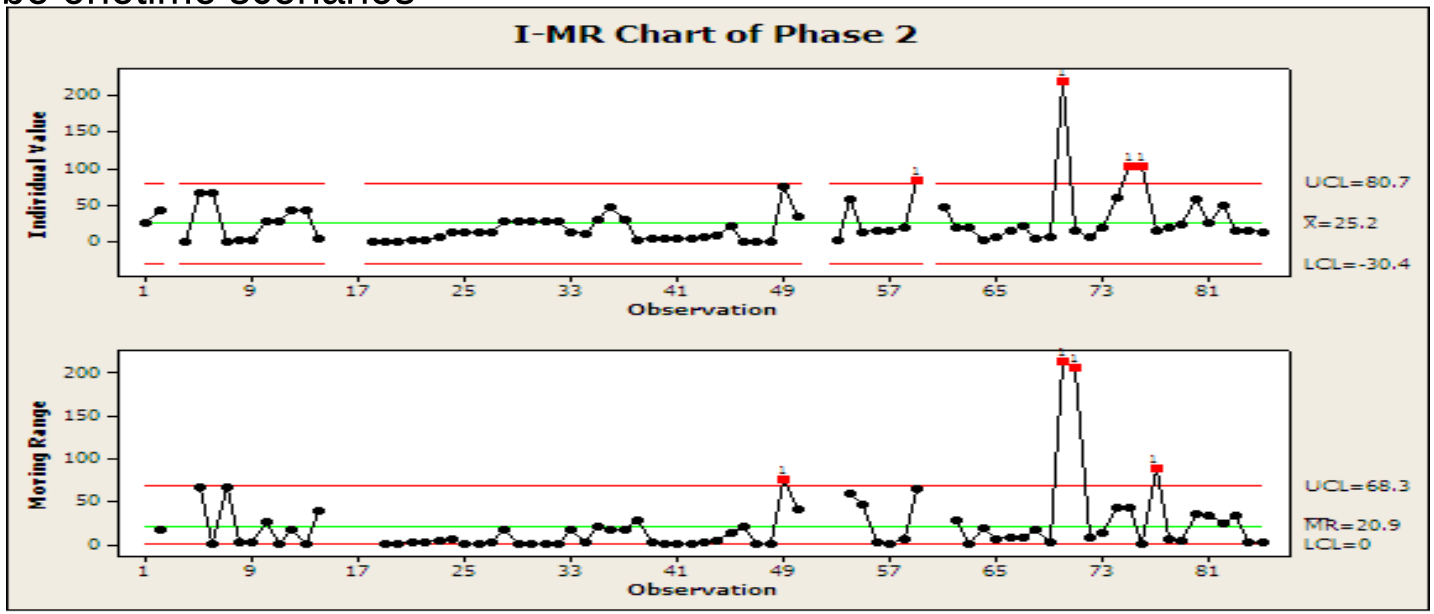
ANOVA test showing significant & statistical difference for fix time for critical defects



* Representative data

# TOOLS: I-MR Charts

- First - verify Process is stable: I-MR charts to identify outliers. Outliers turned out to be onetime scenarios




- Divided the analysis into phases to implement the correction for an identified cause, and statistically analyzed the results – iterative process
- Establish targets at every phase (Based on “Half Life metric” developed by Art Schneiderman - also referenced in The Balanced Scorecard by Kaplan and Norton)

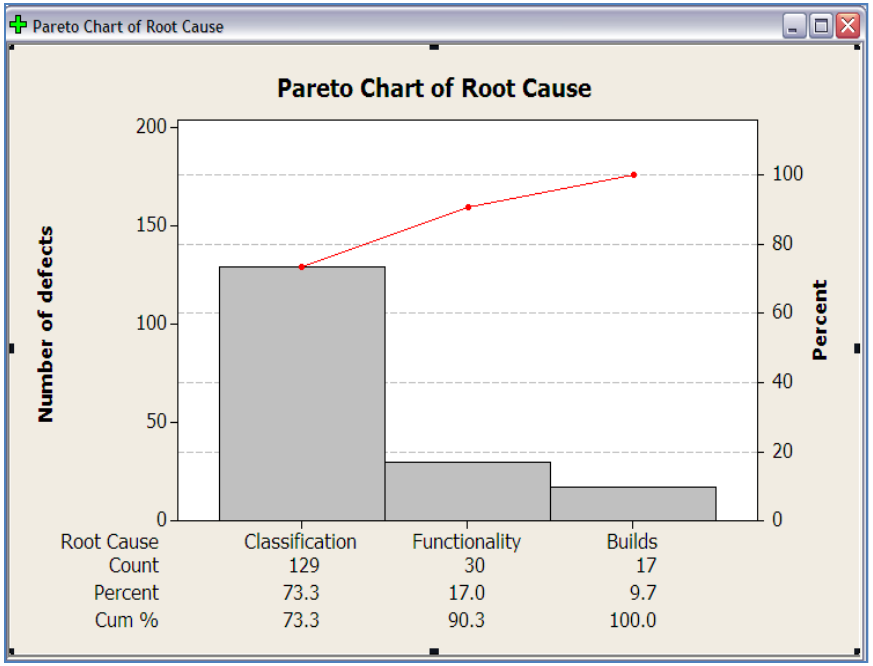


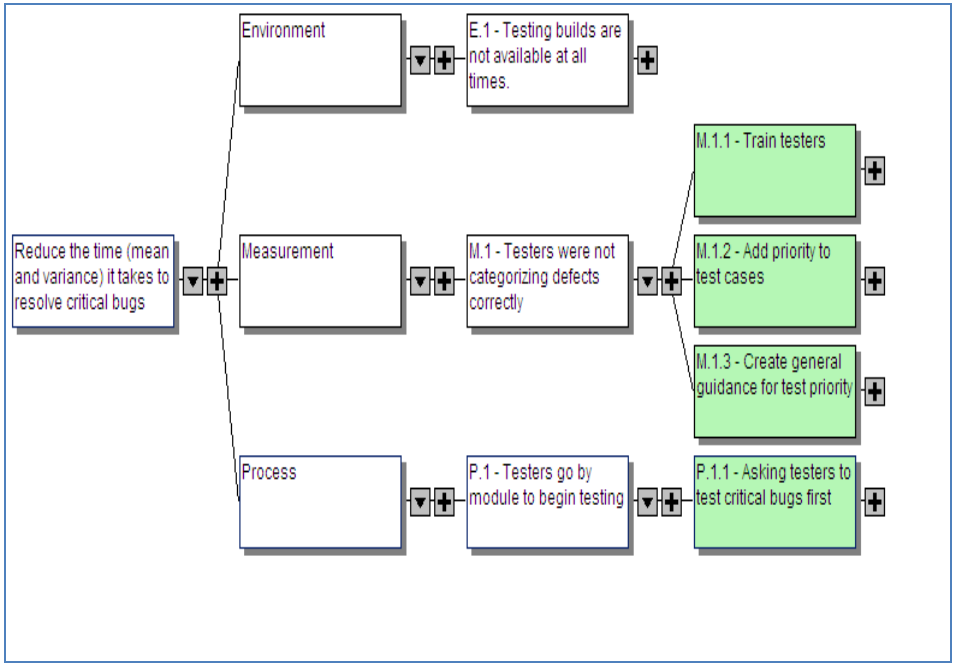
* Representative data

# The CAR Process

**Cause** → Analyze → Resolve

- Brainstorming session
- Fishbone diagram
- Potential root causes identified




* Representative data

# Analysis

Cause → **Analyze** → Resolve

- **Effort vs Impact** analysis to identify the priorities of the actions to implement

| Effort \ Impact | High | Medium | Low |
|---|---|---|---|
| Low | 1 | 2 | 3 |
| Medium | 2 | 3 | 4 |
| High | 3 | 4 | 5 |

| Action | Effort | Impact | Priority |
|---|---|---|---|
| **E.1. Test builds are not ready at all times. There may be a delay.** | Medium | Medium | 3 |
| **M.1. Train Testers to classify defect severity correctly** | Low | High | 1 |
| **M.2. Add priority to test cases** | High | Medium | 3 |
| **M.3. Ask Testers to test according to priority in functionality** | Medium | Medium | 2 |
| **P.1. Add priority to test cases according to Severity (Identified in Phase 3)** | Low | High | 1 |

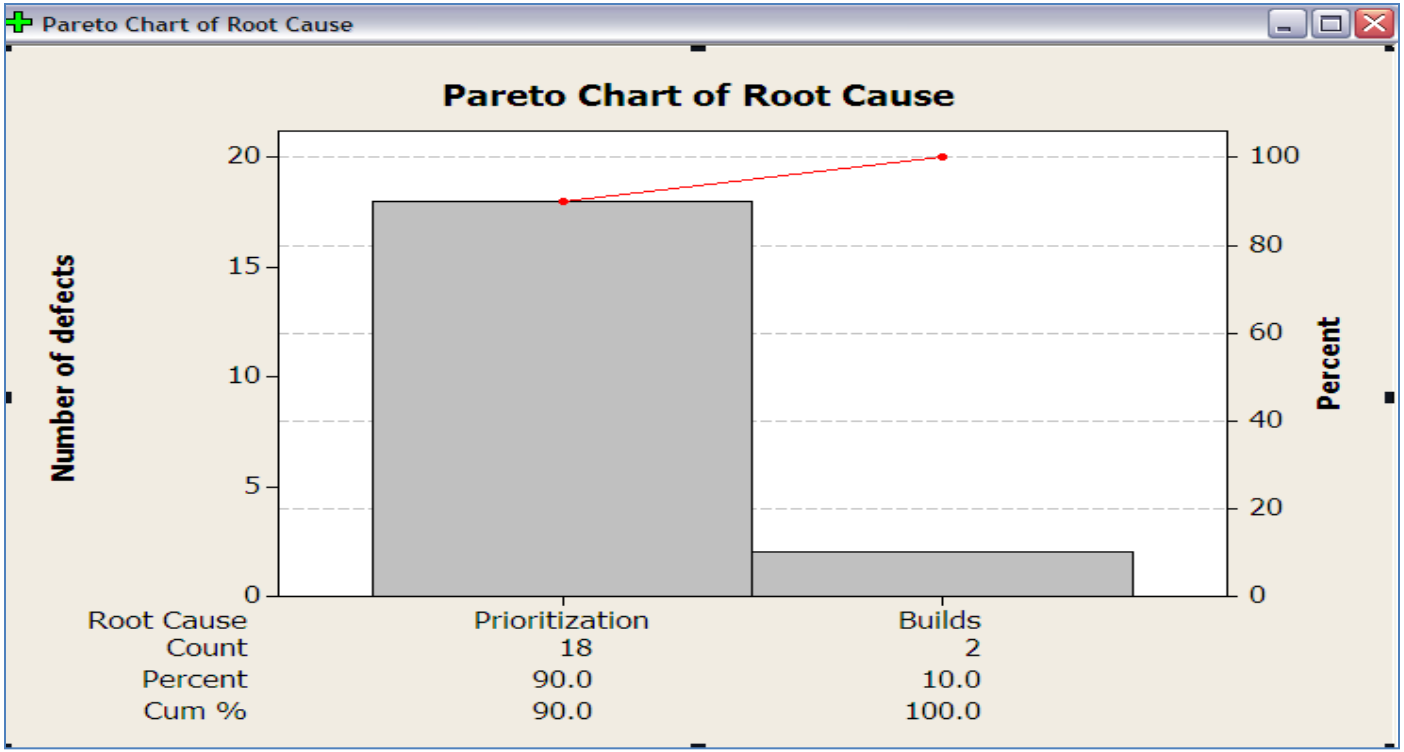


* Representative data

# Analysis(contd.)

Cause | **Analyze** | Resolve

- Pareto Charts to determine the root causes of the problem (that were addressed), monitoring and recording of the data also helped bring about other issues that we were able to resolve quickly

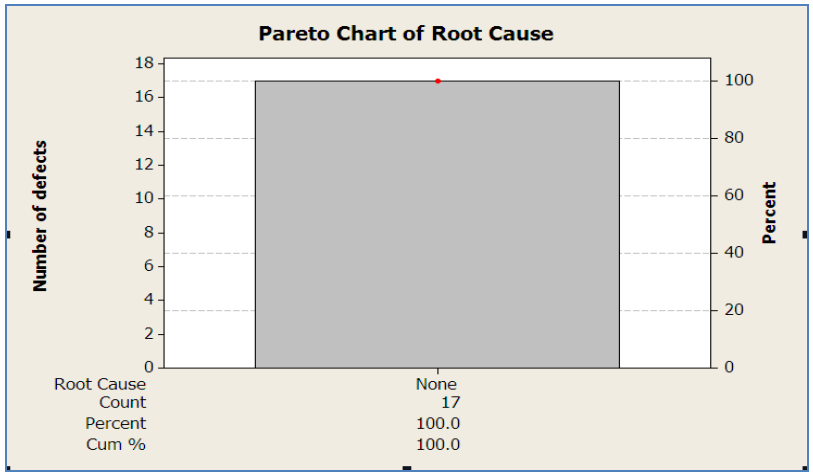


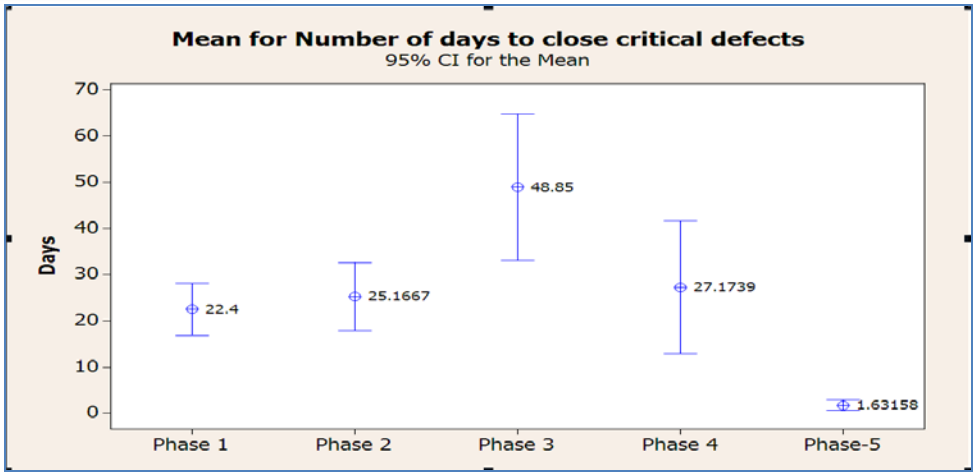



* Representative data

# Results

Cause → Analyze → Resolve




**Mann-Whitney Test and CI: Phase 2, Phase 5**

| | N | Median |
|---|---|---|
| Phase 2 | 78 | 15.000 |
| Phase 5 | 19 | 0.000 |

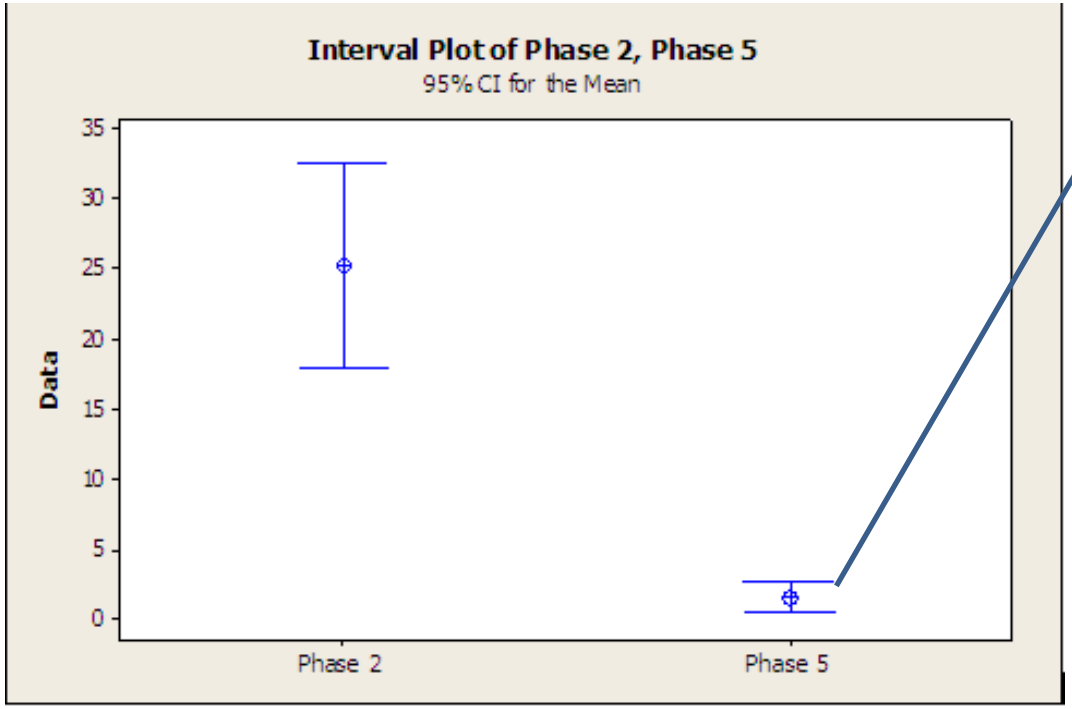
Point estimate for ETA1-ETA2 is 14.000
95.1 Percent CI for ETA1-ETA2 is (7.999,22.001)
W = 4394.5
Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.0000
The test is significant at 0.0000 (adjusted for ties)

The mean time to close critical defects is now at 1.6 days and the standard deviation is at 2.36 – from a mean of 25 days and standard deviation of 32



* Representative data

# Conclusion




- Significant shift in the mean and standard deviation
- Assumptions may not always be true
- Statistical data and analysis = Quantified information
- Increased confidence in the process that was changed and standardized = improved team direction and common goals
- Faster delivery of a quality product = Improved customer satisfaction

# Case Study - II

Using QPM to dynamically manage our program to optimize expected project objectives

# Project Background

- Customer

  Government Agencies reconciling asset discrepancies between systems

- What triggered the Task

  Audit Finds needed to be addressed and resolved with a deadline

- Task I - Phase I Objective

  Analyze and Validate the existence of 3660 assets and provide a resolution

- Schedule

  Start Date: 01/29/2010 – End Date: 04/16/2010

- Team Size

  7 FTEs

# Introduction

- What?
  - Model to predict quantity of assets processed
- Why?
  - Increase in project scope by 40%
- Who?
  - Developed by SEPG team and project team
- Who?
  - Project Management and Leadership team
- When?
  - Weekly

# Business and Project Goals

- High Level Business Goal
  - Have all assets analyzed and reconciled in time for the external audit
  - Credibility of the client organization was riding on the success of this effort
  - Divide and conquer – divide the work amongst various teams
- Project Level Goal
  - Have all assets assigned to our team processed to meet an internal deadline
  - Leave enough time for the customer to review our analysis
- Need for the model
  - 40% increase in scope at the 50% schedule marker
  - Slight delay in receiving the assets

# Risks in meeting business and Project Goals

## RISKS / IMPACTS / MITIGATION

| ID | Risk | Description | Business Impact | Mitigation | Likelihood | Impact Score | Risk Score |
|---|---|---|---|---|---|---|---|
| 31 | Delays from AFO to provide all work packages by 3/12/2010 may impact OST schedule to meet 4/30/2010 milestone | The work packages from the regional POCs will be provided to OST on 4/1/2010. Our initial understanding was that these work packages will be provided to us for review by 03/12/2010. All work packages will still have to be reviewed and field verification where required has to be completed by 4/15/2010.<br><br>OST has 420 assets to process as of 3/18/2010 which will be likely be done by 3/24/2010 at which point OST resources will be waiting for work papers for about 4 days. | • **Schedule**: 4/15/10 milestone may not be met **Cost**: OST resources will not be working at full capacity which has a cost impact | • AFO Provide total assets remaining 1,496 at the rate of 100 per day (~4/2/10) | High | High | **High / Red** |
| 33 | AFO may escalate more than 2/3 of assets (1952) which will impact the schedule, the scope and the budget allocated for the tasks | Based on discussion with AFO, OST and AJW-21 we estimated that 2/3 of the assets not resolved by AFO will be processed and resolved by OST. If more than 2/3 of the assets are escalated to OST this may have an impact on the schedule and the budget of Task 1. | • **Cost** | See Next Slides | High | High | **High / Red** |

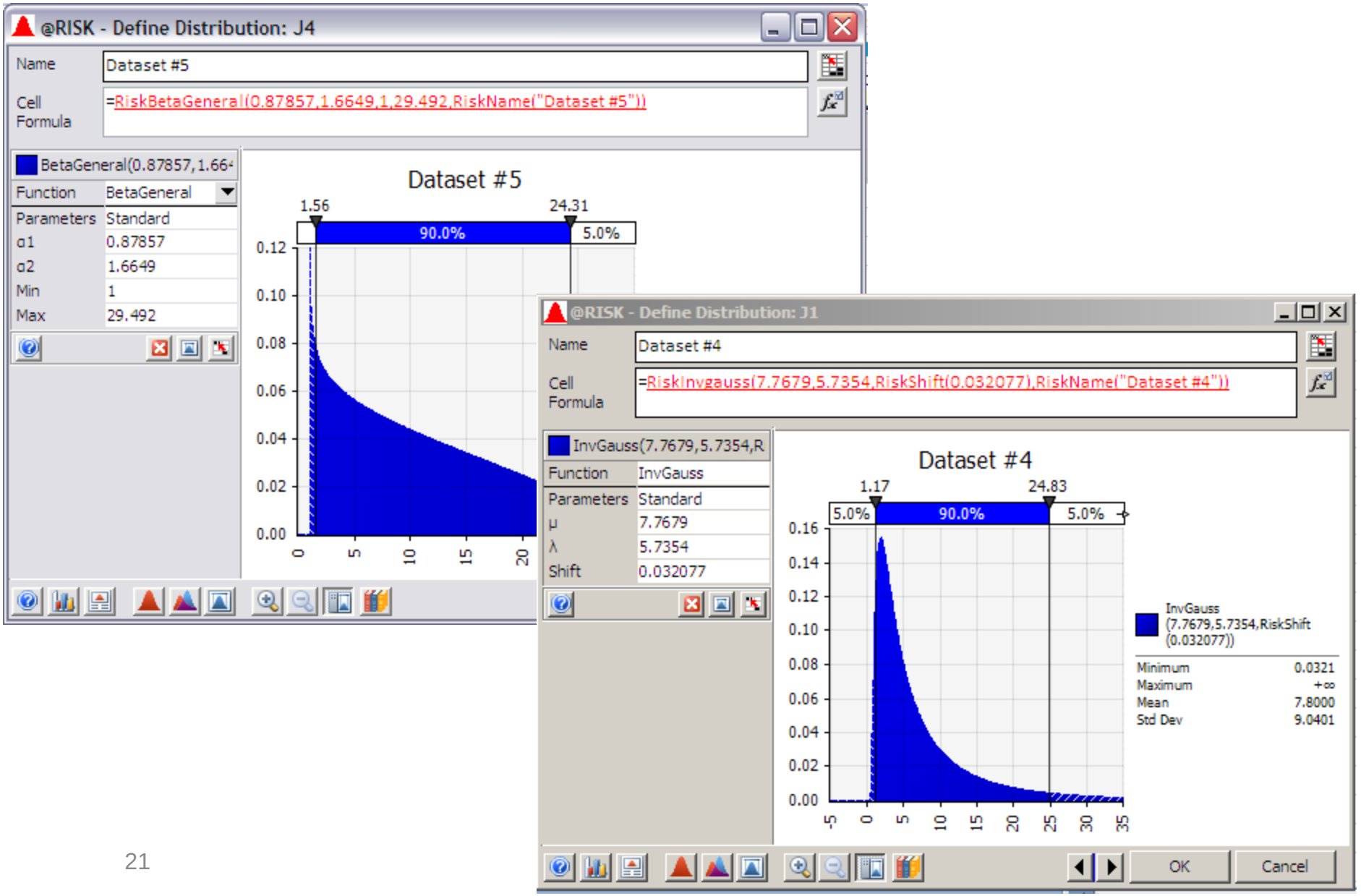
# Outcome(s) Predicted and Stakeholder Audience

- Outcome predicted
  - Number of assets processed (with Confidence Interval and Prediction Interval)
  - Data type – Continuous
- Purpose of the output
  - Determining optimal number of resources needed that we could propose to the customer
- Stakeholders
  - Customer (Government Agency)
  - OST resources (Analysts)

# Data Collection

- Data Collection:
  - 165 data points from Phase I analysis data
  - All data analyzed was recorded and stored using SQL Server
  - Analyzed data was grouped by resolution (Resolved, Retired, Needs Supporting Documentation, etc…)
  - Analyzed data was grouped by analyst
- Time period of data collection
  - Baseline is 2/18/2010 – 3/17/2010.

# Distribution Fitting



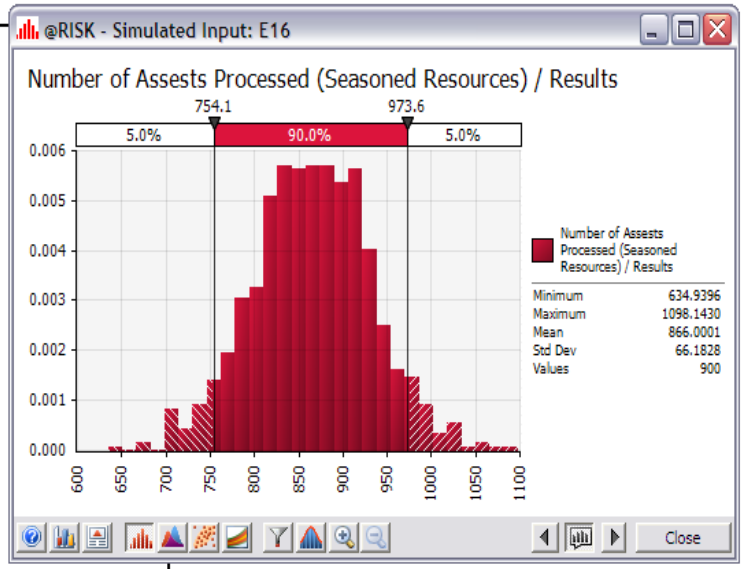
# The Model

- Monte Carlo Simulation was used to predict the output (Response)
- @Risk simulation software was used.
- Output was calculated using the function containing input variables and baseline data

| Model | Simulation |
|---|---|
| $f_x$ =RiskCompound(E12,Baselines!J4) | |

- Histogram for the output is produced after model is run using @Risk.

| | |
|---|---|
| Net working Days | 8 |
| **New Resources:** | |
| # | 0 |
| Net New Resource Work Days | 0 |
| **Seasoned Resources:** | |
| # | 10 |
| Net Seasoned Resource Work Days | 80 |
| **Results** | |
| Number of Assests Processed (New Resources) | |
| Number of Assests Processed (Seasoned Resources) | 867.3406469 |
| Total Assets Processed | 867.3406469 |



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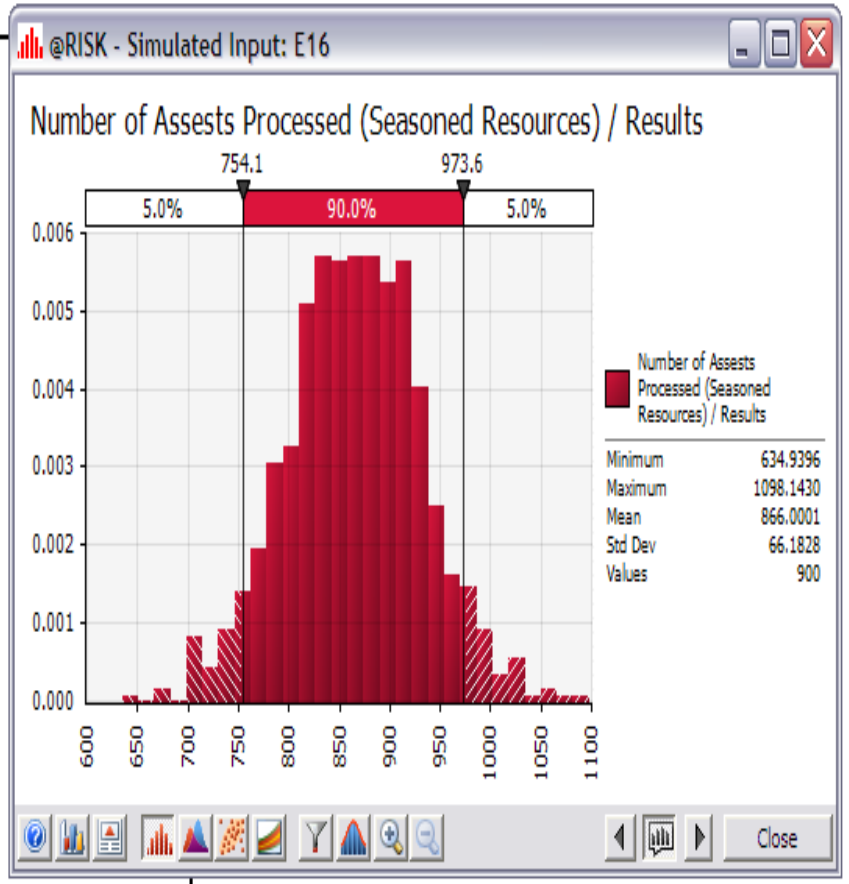

# Risk Mitigation Scenarios presented to the customer

| | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| Description | Meet 4/16/2010 with increase Scope | Meet 4/30/2010 deadline with increase scope | Maintain status quo with increase scope |
| Assumptions | Receive all work papers by 4/2/2010 at rate of 100 / day starting 4/22/2010 | Receive all work papers by 4/2/2010 at rate of 100 / day starting 4/22/2010 | Receive all work papers by 4/2/2010 at rate of 100 / day starting 4/22/2010 |
| Action Plan | • > 95% Confidence: Add 9 Team Members<br>• 60 % Confidence: Add 8 Team Members<br>• 6 % Confidence: Add 6 Team Members | •95% Confidence: Add 3 Team Members<br>• 85% Confidence: Add 2 Team Members<br>• 10% Confidence: Add 1 Team Member | Continue with current staffing level |
| Impact | Cost | Cost / Schedule (15 days – April 30th 2010) | Cost / Schedule (40 days – May 17th 2010) |

# Results and Benefits

- Results
  - Increase in staff was authorized
  - Contract value increased by 50%
  - Contract was changed from FFP to T&M
  - Critical customer deadline of 4/30 was met
- Benefits
  - The ability to make the case statistically provided analytical credibility
  - Increase in Client confidence and reputation
  - Client began advertising OST's modeling capability with the entire customer organization

# What Worked Well

- Excitement about the potential of modeling
- Generating support for dedicated resources for modeling
- Customer Delight
- Using this as a success story to build 9 more models

# Summary

- Increase in asset analysis scope
- Creating model using Montecarlo Simulations to provide confidence levels with different staffing numbers and days
- Multiple scenarios were provided to the customer to choose from
- OST met the critical customer deadline of 04/30/2011
- The ability to make the case statistically provided analytical credibility
- Increase in Client confidence and reputation
- Other models were created due to its success

# Questions

# Thank You