

Air  
Land  
Sea  
Space  
Cyberspace

Innovation. In all domains.

# Why CMMI® Maturity Level 5?

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**Raytheon Integrated Defense Systems**

NDIA CMMI® Technology Conference and  
User Group

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# Agenda

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- Overview
- Why CMMI® Maturity Level 5?
- Quality and Process Performance Objectives
- Raytheon Integrated Defense Systems Return on Investment
- Summary

## Overview

# Why Maturity Level 5?



Where's the benefit?

It costs too much! Who's paying for this?

Maturity Level 3 is all we can afford!

My customer says I only have to be Maturity Level 3!

What is the impact of Maturity Level 5 on business goals?

This presentation will summarize:

- Why CMMI® Maturity Level 5 offers value to a business
- Benefits Raytheon Integrated Defense Systems has realized from deploying Maturity Level 5 processes

# High Maturity Controversy



Founding Fathers Debate High Maturity

SW  
CMM<sup>®</sup>

Gansler  
Memo

CMMI<sup>®</sup>

# The Race is On!



**RFP**  
.....must  
be....  
...Level 5

**RFP**  
.....must  
be....  
...Level 5

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.....must  
be....  
...Level 5

**RFP**  
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**RFP**  
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...Level 5

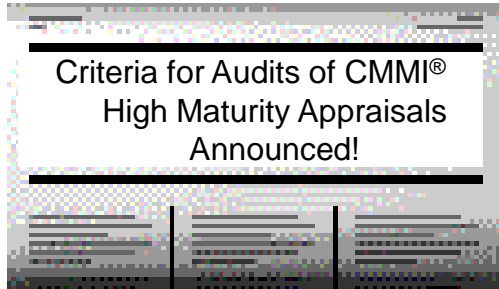
# Fallout!

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“We have five maturity levels.  
We know three of them work.”

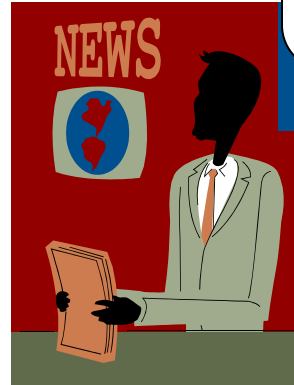
Mark Schaeffer  
Office of the Under Secretary of Defense  
NDIA CMMI Technology Conference, 2007

# Response!

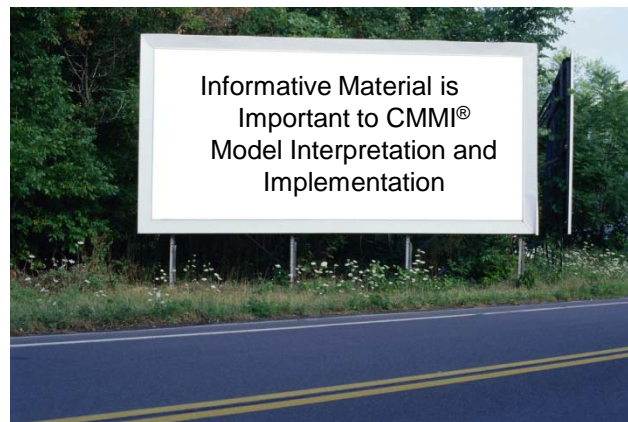


And now... 11  
Frequently  
Misinterpreted  
ML 4-5 Practices!

SCAMPI<sup>SM</sup> High Maturity Lead  
Appraiser Certification  
Announced!



Next up: High Maturity  
Misconceptions - Common  
Misinterpretations of CMMI<sup>®</sup>  
Maturity Levels 4 and 5!



If You're Living the High  
Life You're Living the  
Informative Material!



# Why CMMI® Maturity Level 5?

- CMMI® was created to support business improvement
  - CMMI® is a means to an end, not an end unto itself
  - As a model containing best practices, CMMI® is a business strategy tool to help achieve business objectives
- Business objectives often differ based on an organization's level of maturity
  - ML 2 and ML3 are about avoiding disasters and gaining control
    - ML 2 organization objectives: avoid disasters due to unrealistic plans, lack of requirements management, poor CM, management without progress measures, etc.
      - Example: begin measuring individual project productivity
    - ML 3 organization objectives: increased consistency of performance, common organizational process tailored by all projects, proactive project management
      - Example: collect productivity on all projects using a tailored common process
  - ML 4 and ML 5 are about managing against quality and process performance objectives to improve performance capability
    - ML 4 and ML 5 organization objective: quantitatively manage ability to perform against *quality and process performance objectives that align with business objectives*, take action accordingly, and perform causal analysis to improve performance
      - Example: understand variation in productivity, quantify ability to perform against productivity objective, target corrective action to improve productivity at project and organizational levels



# CMMI<sup>®</sup> Maturity Level 3 vs. Level 5

## Maturity Level 3

PMC SG1: Actual performance and progress of the project are monitored against the project plan.

IPM SP 1.5: Manage the project using the project plan, the other plans that affect the project, and the project's defined process.

OPF SG1: Identify improvements to the organization's process and process assets.



CMMI<sup>®</sup> ROI Scale

## Maturity Level 5

OPP SP 1.3 Establish and maintain *quantitative objectives for quality and process performance* for the organization.

QPM SG1: The project is quantitatively managed using *quality and process performance objectives*.

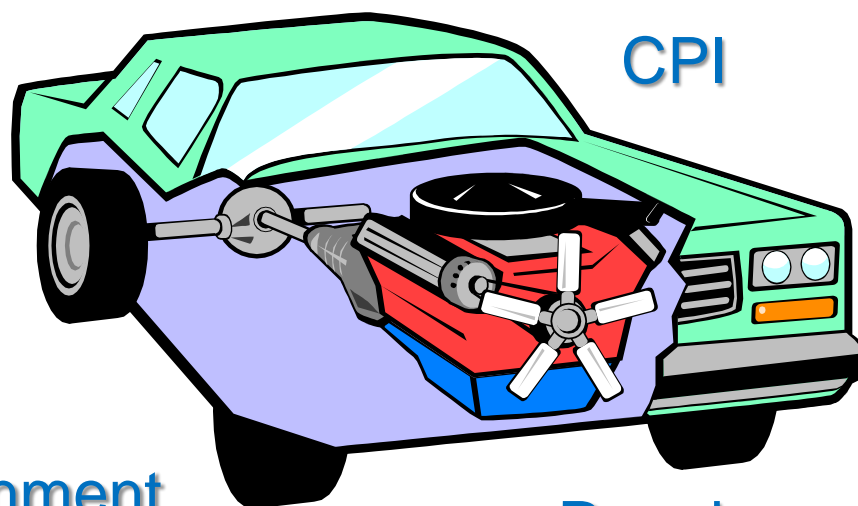
OID SG1: Process and technology improvements, which contribute to meeting *quality and process performance objectives*, are selected.

# Quality and Process Performance Objectives

The engine that drives project performance

The engine that drives business performance

Productivity  
Defect Density  
Defect Containment



CPI  
SPI  
Requirements Volatility

The engine that drives high maturity

# IDS Quality & Process Performance Objectives

## Raytheon Goals

Be regarded as a customer focused company.

Grow revenue faster than market. Build on good performance in improving cash flow. Execute well and with predictability.

Retain and attract world-class talent while providing superior opportunities for employee development. Treat all employees with respect. Leverage our diversity efforts as a competitive advantage, continuing Raytheon's leadership in diversity.

Improve ROIC for Raytheon Company. Take R6σ™ to the next level, further engaging customer and partners. Deliver greater value and predictability through IPDS, EVMS, and CMMI®.



## Raytheon Integrated Defense Systems (IDS) Goals



## Raytheon IDS Engineering Quality and Process Performance Objectives

Cost	Schedule	Quality	People
<b>CPI ≥ X</b> <b>Productivity X% &gt; Bid</b> <b>Defect Containment ≥ X%</b> <b>Requirements Volatility ≤ X%</b>	<b>SPI ≥ X</b> <b>Productivity X% &gt; Bid</b> <b>On-time Deliverables Average &gt; X%</b>	<b>Defect Containment ≥ X%</b> <b>Defect Density &lt; X</b> <b>Requirements Volatility ≤ X%</b>	<b>Average X Hours Training per Employee</b>

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# Raytheon IDS

## Return on Investment from Implementing CMMI® Maturity Level 5

# Assumptions - 1

- Data used in this study compared IDS 2005 performance 2005 - 2008
  - IDS achieved ML 3 for SE/SW in 2003, ML 4 for SE/SW & ML 3 for HW in 2005, and ML 5 for SE/SW/HW in 2008
- Actuals and Estimates
  - In most cases, actual data was used in this study. If actuals were not available, conservative estimates were used with rationale
    - Projecting future return from CAR/OID projects is generally estimated
- Defining “Investment”
  - The cost of all activities to incorporate maturity level 4 & 5 practices into our business processes and be appraised
    - Appraisal costs, development and deployment of updated processes and enablers (e.g., process performance models), and training
- Calculating “Savings”
  - Apply baseline rates (e.g., 2005 productivity) against 2008 size (e.g., lines of code) to calculate “projected cost at baseline rates”
    - Projected cost at baseline rates = “2005 productivity” \* “2008 size” \* “2008 labor rate”
  - Compare “projected cost at baseline rates” to 2008 actuals
    - Savings = “projected cost at baseline rates” - 2008 actuals

# CAR/OID

- Sample included 19 CAR/OID process improvement projects
  - 14 CAR, 5 OID

	Total ROI	Highest ROI	Lowest ROI	Median ROI	Number of data points
ROI on CAR/OID projects	38.4 : 1	183.3 : 1	1.9 : 1	14.3 : 1	19
ROI on OID projects	57.1 : 1	183.3 : 1	10.7 : 1	50.8 : 1	5
ROI on CAR projects	25.8 : 1	85.5 : 1	1.9 : 1	9.6 : 1	14

- The large ROI on CAR/OID projects is not surprising
  - CAR/OID projects focus on IDS Engineering goals
  - 7 Defect Containment, 10 Productivity, 1 CPI, 1 Measurement Team Training
- OID ROI is much higher than CAR projects
  - Benefits seen across programs provides more ROI

*Applying CAR project improvements wider across the enterprise would result in more savings*

# Systems Engineering

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- Requirements Volatility
  - 56.1% improvement
- Requirements Development Productivity
  - 14.3 % improvement
- CPI
  - 4% improvement
  - CPI variance reduction of 63%

# Software Engineering

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- DCTI Productivity
  - 65% improvement
- Defect Containment (SW Design through SW Maintenance)
  - 11.6% improvement

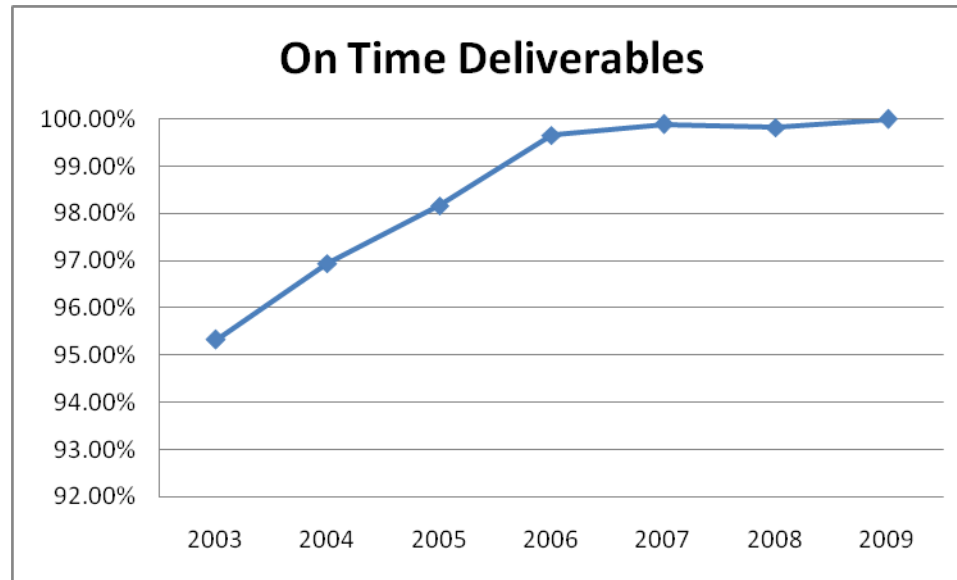


# Hardware Engineering

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- Mechanical Engineering Productivity
  - 25 % improvement
- Electrical Design Productivity
  - Analog: 33% improvement
  - Digital: 56% improvement
- Defect Density for Drawing Checking
  - 65% improvement

# On Time Deliverables



Year	2003	2004	2005	2006	2007	2008	2009
OTD	95.32%	96.94%	98.17%	99.66%	99.89%	99.82%	100.00%

Through May

On Time Deliverables increase 4.9% since 2003.  
 On Time Deliverables > 99% since 2006.

# Return on Investment

Quantified ROI from IDS CMMI<sup>®</sup> Maturity Level 5 activity: 24 : 1

- Comparison with industry – from “*Performance Results of CMMI<sup>®</sup> -Based Process Improvement*”, August 2006, CMU/SEI-2006-TR-004
  - Median ROI 4 : 1
  - Lowest ROI 1.7 : 1
  - Raytheon IDS 24 : 1
  - Highest ROI 27.7 : 1
- IDS results are a direct consequence of meaningful process improvement aligned with the business and engineering objectives
  - Focus on major savings items: productivity, defect containment, CPI/SPI produces real results – the essence of Level 5!



# Summary

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- What an organization gets out of process deployment and CMMI<sup>®</sup> appraisals is a reflection of what the organization puts into it
  - Organizations that focus on a maturity level number and “minimal compliance” are unlikely to derive any benefits
- High maturity, with its focus on quality and process performance objectives, puts organizations and projects in a position to succeed
  - OPP applies statistics to management
    - Establish quality and process performance objectives
    - Process performance models that illuminate potential problems in achieving objectives and address real project issues are invaluable to the organization
    - Process performance baselines identify the ability of the organization and its programs to perform in relation to their objectives
  - QPM and CAR push organizational objectives into projects’ daily activities
    - Makes the objectives real to projects, and not just rhetoric
    - Helps projects more fully understand their role in business success
    - Having organizational/project goals in project metrics charts focuses project reaction when objectives are not being
  - OID prioritizes process improvements based on their relationship to objectives

## Summary (continued)

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### All Maturity Levels offer benefits

- Maturity Levels 2 and 3 help prevent disasters and gain control
  - Are not focused on quality and process performance objectives as a the driver of process improvement activity
  - Set a low ceiling on benefits of CMMI® - based process improvement
- Maturity Levels 4 and 5 manage ability to perform against quality and process performance objectives that align with business objectives, and take action accordingly

A high maturity organization where all individuals recognize their role and responsibility for business success is an organization that is more likely to achieve success.

# Questions



# Contact Information

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- For future questions the presenter contact information is:

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# Presenter Biography

- Michael Campo is a Principal Engineering Fellow at Raytheon Company, with 32 years experience that includes roles as a software developer, software/system integrator, manager, software project manager, and process group leader. As process group leader for Raytheon Integrated Defense Systems, Mike developed and deployed processes that led to achievement of CMMI Maturity Level 3 in 2003, Maturity Level 4 in 2005, and Maturity Level 5 in 2008.
- Mike's present position is IDS Process Technical Director. He is a certified CMMI Instructor. Mike is a member of the CMMI V1.3 Core Model Team, the CMMI V1.3 Training Team, the CMMI Configuration Control Board, and the NDIA CMMI Working Group.

