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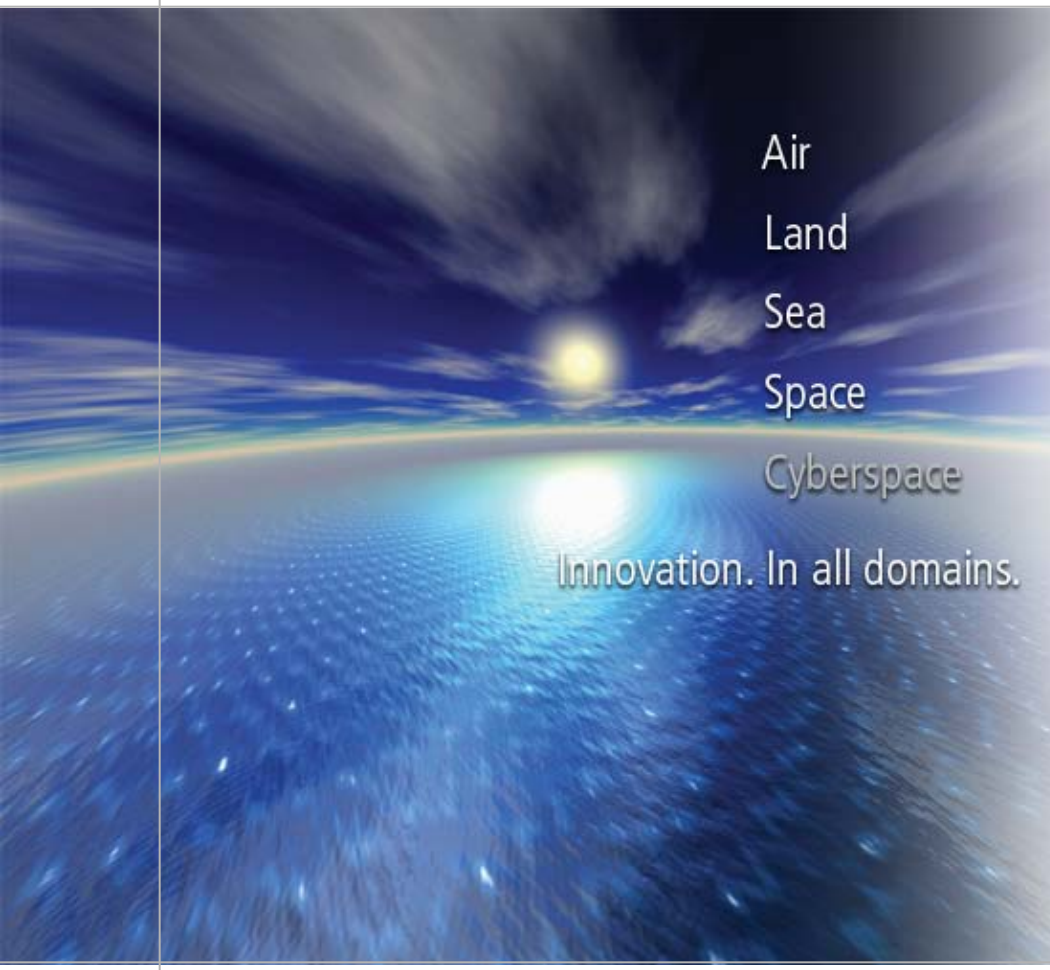
Customer Success Is Our Mission



We're Already There

Matching Existing Behaviors to the CMMI® Model at RMS

Bradley Bittorf

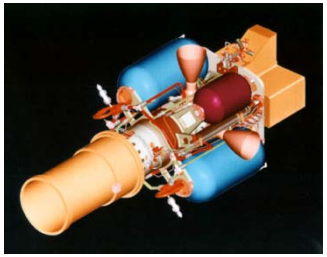
Raytheon Missile Systems

Outline

- Background
- Approach
- Old vs. New Approaches to CMMI Compliance
- Existing High Maturity within Raytheon Missile Systems
- Connecting RMS' High Maturity to CMMI
- Benefits and Challenges to Our Approach
- What We Learned
- How Did it Turn Out?
- Questions
- Presenter Biography
- Backup

Raytheon Missile Systems' CMMI® Environment

- Raytheon is comprised of multiple business units
  - One business unit is Raytheon Missile Systems (RMS)
    - Characterized by high-(defense) volume, complex systems--"Rocket Science"
  - Each business unit manages its own CMMI® goals and appraisals
    - Knowledge sharing across business units
    - Each business unit manages its own CMMI budget and CMMI program approach, risks, etc.
    - Drew from Raytheon and RMS experience with prior SW-CMM, CMMI appraisals
- RMS Executive Management sponsored a CMMI Level 5 appraisal





Traditional CMMI Compliance Approach

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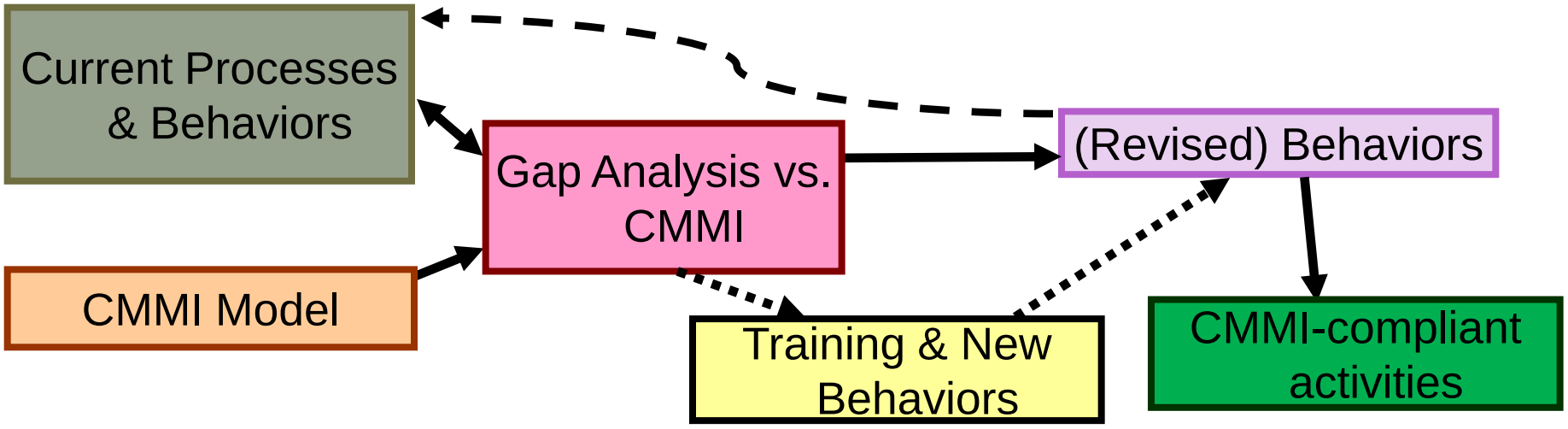
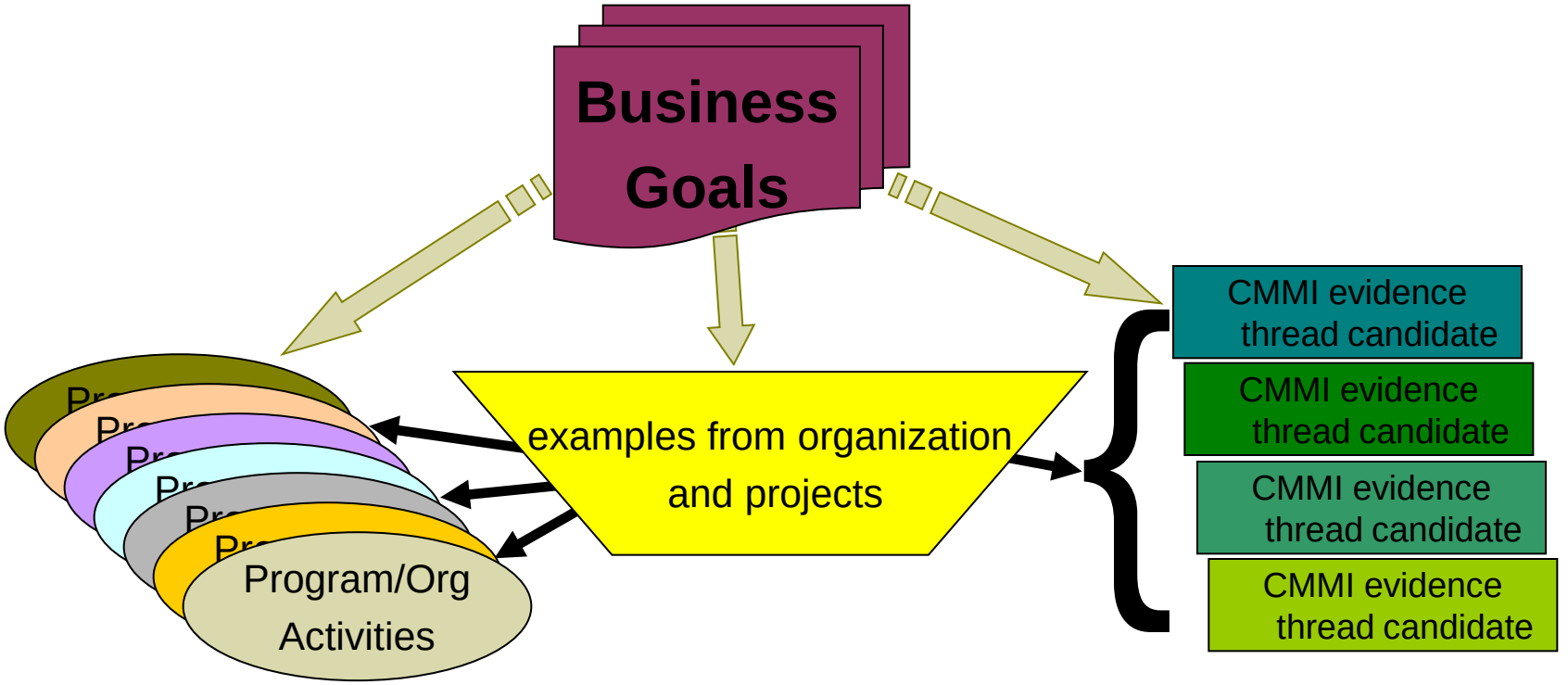
- Past RMS CMMI Maturity Level 3 (Staged) certifications have used traditional approach shown below
  - assess compliance of current activities to CMMI
  - prepare a gap analysis of activities against CMMI
  - institute new behaviors to fill the perceived CMMI gaps:
    - formulate training
    - inject training into programs and organization
  - iterate as necessary

This can be a "pushing" process which can require resources and force to overcome inertia



RMS CMMI Notional Approach

- We didn't invent or introduce behaviors
- We sought out those places in the organization where we were already performing at in a CMMI-compliant way
- Activities are in support of business goals



RMS 2009 CMMI Compliance Approach

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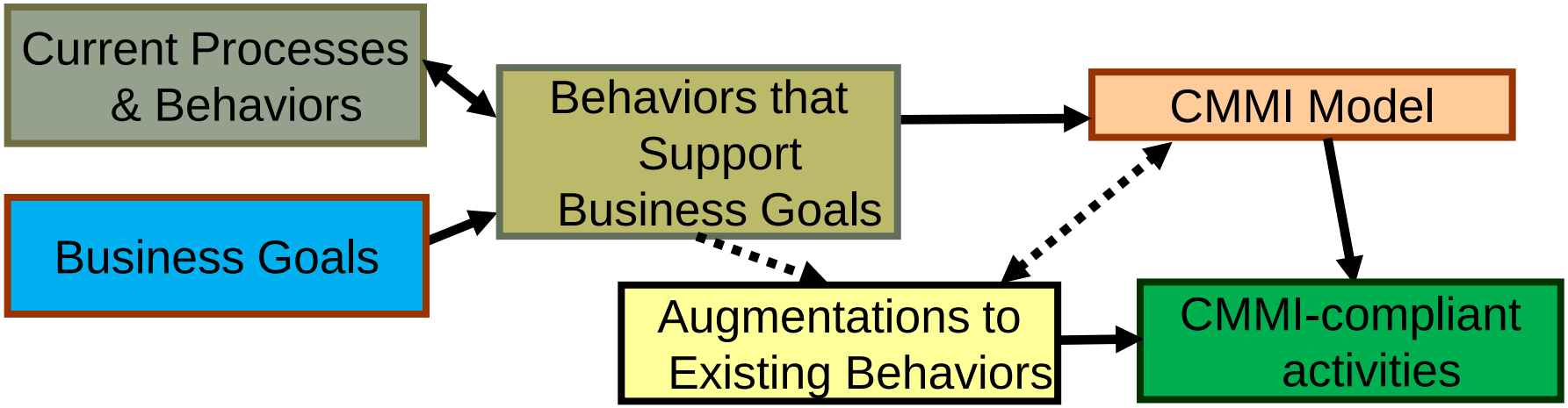
- Departed from RMS' historic appraisal methods
  - Felt some previous appraisals were thorough but costly
  - Accepted higher risk in approach if no business value gained, in trade for cost, effort savings
- Identified a library of competencies within the organization
- Developed view of how existing behaviors satisfy CMMI PA's
- Identified practices throughout the organization that comply with CMMI
  - ensured the approach is centered on what the organization already valued
    - "Business-goal-centric" approach vs. "appraisal-centric" approach



Conversion: Examples of Old vs. New Approaches to CMMI Compliance

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CMMI Model Element	Old Way	New Way
Generic Practice [GP] 2.9	Prescribed "Objective Evaluation" plan and schedule— "extra" product and process check	Utilize existing compliant activities: AS9100 audit, ISO9000 audits, DCMA audits, Software Quality audits, Gate "Internal Reviews". . .
Measurement & Analysis, GP2.8, GP2.10	Prescribed additional meeting to review metrics with specified stakeholders	Leverage existing periodic meetings that programs already hold with many stakeholders to review metrics and program status
Decision Analysis and Resolution [DAR]	Organization directed use of DAR plan	DAR policy may be embedded in risk management, technical, program management plans—or in a stand-alone DAR plan

Key Tenets and Socialization

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These key tenets of our approach were socialized—repeatedly—with the CMMI project team and its stakeholders:

- an unwavering centering of our approach on RMS' business goals and priorities
- reduction of risk through reuse of past practices and experience
- continual grounding through frequent consultation of the CMMI model and the Method Description Document [MDD] (rather than of interpretations of it and past "what has worked" practices)
- recognition that the CMMI is designed for sundry organizations and that our approach must satisfy—but not overwhelm—each CMMI element
- use of a paradigm for high maturity built on modeling and simulation to improve designs and solutions before the first products are even realized

At the start of each appraisal team event, the team re-examined and refined its understanding of the approach and its compliance to the CMMI. This understanding was captured in written "leveling agreements" that were used as a basis to tune our understanding through challenges, explanations, and examples.

Where We Found Maturity Level 4/5 Compliant Behavior

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- CMMI team brainstormed possible CMMI High Maturity portions of organization
  - Programs known to be doing sophisticated work and modeling
  - Functional organizations such as
    - System Design & Performance
    - Program Management Excellence
    - Supply Chain Management
    - Raytheon Six Sigma
    - Statistical Design group (a.k.a., Robust Design, a.k.a., Design for Six Sigma)
    - Electrical-Optical Systems Production & Assembly (EOSPA)
  - Friends, contacts, people we used to work for or with
  - Engineering leadership
    - Engineering initiatives
    - Chief Engineers
    - Technology Development
    - Gate review expert
    - Discipline “Process Owners”
  - Product Line Deployment Leads
  - Manufacturing

How We Learned about High Maturity within our Organization

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CMMI project team members:

- Met with everybody on prior slide
  - Asked them about what they did (didn't ask them about CMMI)
- Brought back what we learned and discussed possible applicability to CMMI
- Formulated an approach to cover Organizational Process Performance, Quantitative Project Management, Organizational Innovation and Deployment, and Causal Analysis and Resolution based on the content we gathered
- Met again with our points of contact—practitioners—and sought their feedback on what we thought we heard
  - Strived for accuracy in our representation of their practices
  - If practical, discussed how we thought it complied with CMMI
- Down-selected from the possibilities to the most promising "CMMI evidence threads"

Connecting What We Learned about RMS' High Maturity Activities to CMMI

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CMMI team members:

- Consulted Raytheon experts and other experts in CMMI to understand how they approached high maturity
- Conducted a review of our proposed high maturity approach with several high maturity experts within Raytheon
  - established that our approach had merit in fulfilling the requirements of the CMMI
  - captured the framework of our understandings and leveling agreements for further team use
  - developed training material to illustrate how our organization meets CMMI requirements for high maturity
  - stayed current -- attended internal seminars, lunch & learn events, community of practice events, briefings about new initiatives

Things We Discovered about High Maturity at RMS

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- The most effective and useful threads were those that could be shown to most directly impact our business goals
- Some infrastructure improvement opportunities existed in high maturity threads
- Examples that parts of the organization, and programs, were predicting and modeling:
  - projects' schedule performance and managing to those predictions
  - key attributes of designs to predict the yield and ability to meet requirements within a project (Key Product Characteristics, Key Process Parameters)
    - They could "dollar-ize" the cost of not meeting requirements
  - trade-offs of attributes of one discipline versus those of other disciplines using a plethora of models to best design the whole system ("multi-disciplinary optimization)
  - characteristics of a design before it was prototyped or manufactured in order to make product design or process improvements to ultimately manufacture the product more reliably and less expensively
    - while CMMI for Development does not include manufacturing, design requirements include many manufacturing considerations that constrain or affect design decisions
  - and much, much more

In short, there was no shortage of possibilities to illustrate high maturity behaviors!

Benefits of Our Approach

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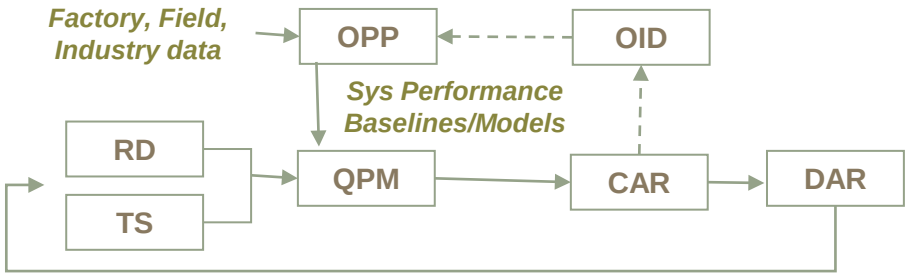
- Allowed CMMI team to show CMMI high maturity compliance without requiring a full set of statistical experts on team
- Saved time and money
  - Very few new/introduced behaviors and training necessary
- Enabled 20-month time to show compliance to Level 5 after certification to Level 3
  - Note that many of the Level 5 activities were already in place at the time of Level 3 recertification
- Easy to show that our goals, measures, behaviors were meaningful since they already were the focus of the business
- Forced us to connect with and understand the CMMI: its meanings and primitives

Challenges to Our Approach

- Different approach required open minds
  - Learning curve, especially for those with prior CMMI experience
- Some “expect” segregated vs. integrated Level 4 and Level 5 activities
- Product and process improvement elements are sometimes integrated
  - Process changes often deal with attributes of a not-yet-determined product
- High maturity process areas such as QPM and CAR are used in determining the requirements and pre-design approach, rather than only being invoked as needed downstream
  - Modeled and predicted capability constrain the product design space, as well as being used to characterize an established product design

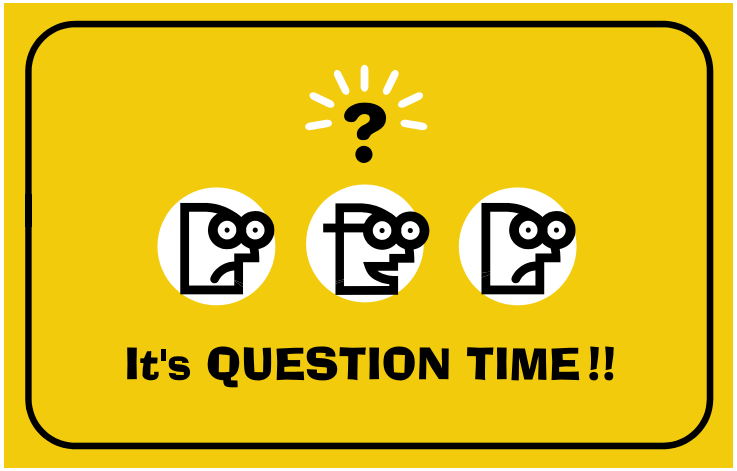


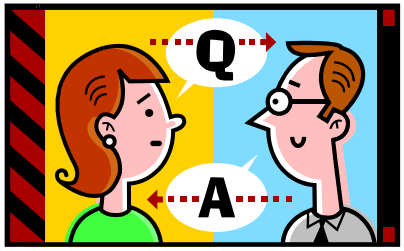
- Teaching “rocket scientists” CMMI, because they like to understand everything in which they participate ☺

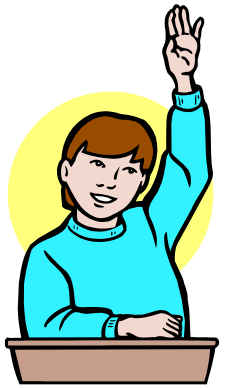
How Did It Turn Out?

- Evidence threads identified during this process were used during the final CMMI Appraisal
  - Many more possible threads were not used
- We frequently learned that high-maturity practices were more widespread than we had realized
  - This realization continued to grow even through the SCAMPI A
- A library of high maturity practices and examples throughout the organization has been compiled
- By tying our threads to our business goals, it was straightforward to show the connections between our quantitative objectives and our organizational actions, models, predictions, etc.
  - Often this had already been done

Questions?







Presenter Biography

Raytheon Missile Systems

Bradley Bittorf

- Senior Principle Multi-disciplined Engineer, Raytheon Missile Systems, Tucson, AZ
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Recent role

- Managed and facilitated CMMI® maturity level 5 program at his site
- Member of the CMMI appraisal team

26 years engineering experience

- Functions: software, systems engineering, program management liaison, process improvements
- Industries: cell phones, industrial automation, missile systems
  - 3 patents – high-reliability systems, redundancy, inter-process communication

Personal

- Long-time science fair judge
- Officer of the International Lilac Society
- Together with his wife Debbie, is a rated geocacher in the desert southwest
- Cat rescue

BACKUP SLIDES

Objectives of Business

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- Grow market leadership in core, international and adjacent markets
  - Strengthen and evolve existing core programs
  - Win two or more major development contracts
  - Increase international business to <V> percent of sales by 2010
  - Win a strategic contract in an adjacent market
- Achieve <$X> in sales by 2010
- Accelerate <Initiative Y> implementation to improve affordability and time to market
- Capture and execute programs with streamlined tools, processes and metrics
- Reduce product and process defects, and cut rework to less than <Z> percent