Lessons Learned from Adopting CMMI for Small Organizations

Sponsored by the U.S. Army Aviation and Missile Research, Development & Engineering Center (AMRDEC) Software Engineering Directorate (SED)

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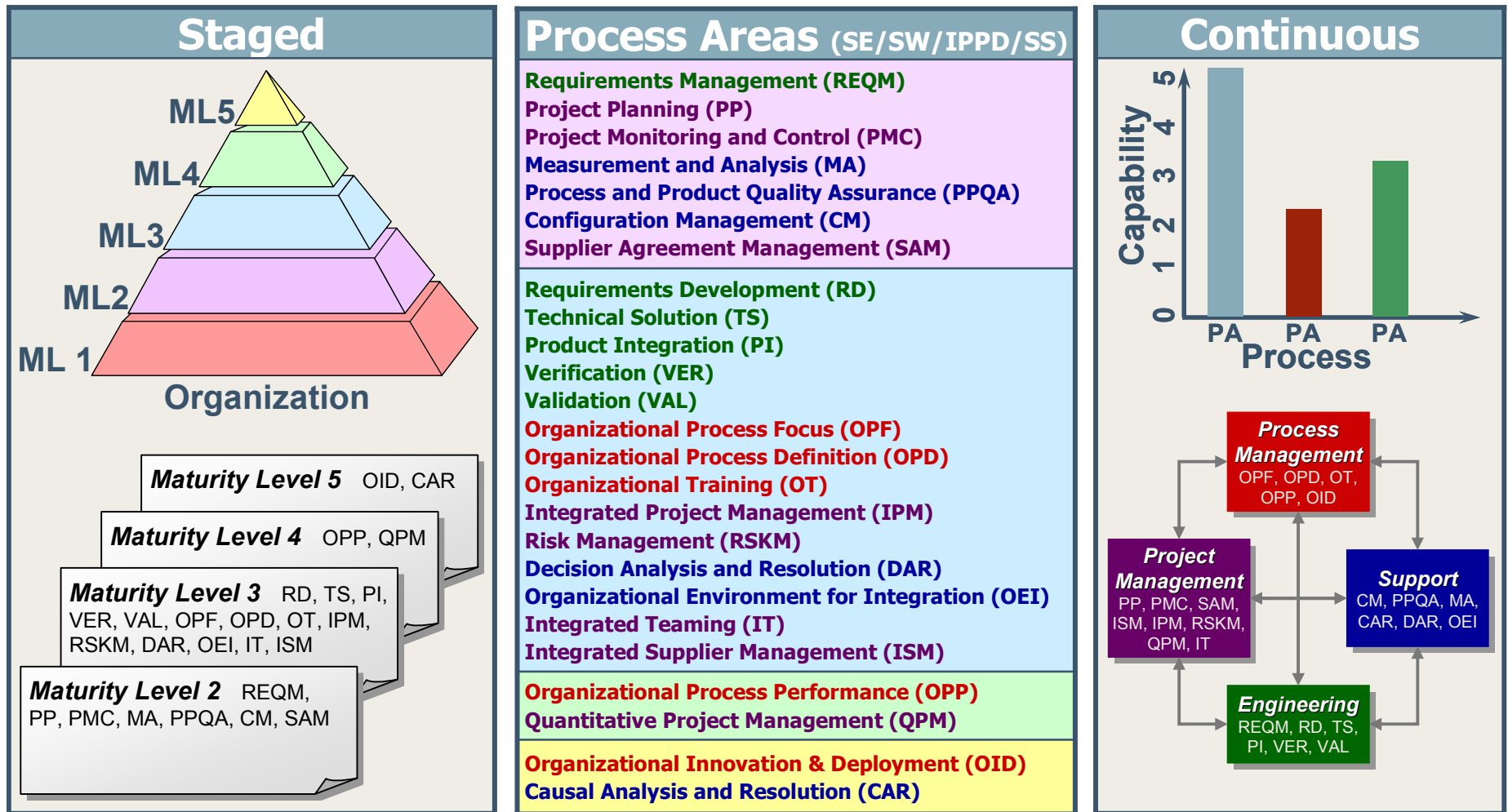Jack Conway, ASI

Agenda

- CMMI Overview

- Pilot Overview

- Adoption of CMMI by ASI and Lessons Learned

- How Pilot Artifacts Can Help Small Businesses

What is the CMMI Model?

- CMMI Is a Process-Improvement Model that provides a set of Best Practices that address productivity, performance, costs, and stakeholder satisfaction

- CMMI Is *NOT* a set of "Bolt-On Processes" that last only as long as the wheel is squeaking. CMMI provides a consistent, enduring framework that accommodates new initiatives

- CMMI focuses on the total-system problem, unlike other predecessor CMMs

- CMMI facilitates enterprise-wide process improvement, unlike single-discipline models

CMMI In A Nutshell

Staged

ML5
ML4
ML3
ML2
ML 1

Organization

Maturity Level 5 OID, CAR

Maturity Level 4 OPP, QPM

Maturity Level 3 RD, TS, PI, VER, VAL, OPF, OPD, OT, IPM, RSKM, DAR, OEI, IT, ISM

Maturity Level 2 REQM, PP, PMC, MA, PPQA, CM, SAM

Process Areas (SE/SW/IPPD/SS)

Requirements Management (REQM)
Project Planning (PP)
Project Monitoring and Control (PMC)
Measurement and Analysis (MA)
Process and Product Quality Assurance (PPQA)
Configuration Management (CM)
Supplier Agreement Management (SAM)

Requirements Development (RD)
Technical Solution (TS)
Product Integration (PI)
Verification (VER)
Validation (VAL)
Organizational Process Focus (OPF)
Organizational Process Definition (OPD)
Organizational Training (OT)
Integrated Project Management (IPM)
Risk Management (RSKM)
Decision Analysis and Resolution (DAR)
Organizational Environment for Integration (OEI)
Integrated Teaming (IT)
Integrated Supplier Management (ISM)

Organizational Process Performance (OPP)
Quantitative Project Management (QPM)

Organizational Innovation & Deployment (OID)
Causal Analysis and Resolution (CAR)

Continuous

Capability (0 1 2 3 4 5) vs Process (PA PA PA)

Process Management
OPF, OPD, OT, OPP, OID

Project Management
PP, PMC, SAM, ISM, IPM, RSKM, QPM, IT

Support
CM, PPQA, MA, CAR, DAR, OEI

Engineering
REQM, RD, TS, PI, VER, VAL

> *Two Representations Per CMMI Model*
> *One Appraisal Method (SCAMPI [SM])*

Pilot Overview

Pilot Project Overview

A joint project performed by the partnership between the Software Engineering Institute (SEI) and AMRDEC SED to establish the technical feasibility of developing guidance and other special-purpose transition mechanisms to support adoption of CMMI by small and medium enterprises (25 to 250 employees in Huntsville)
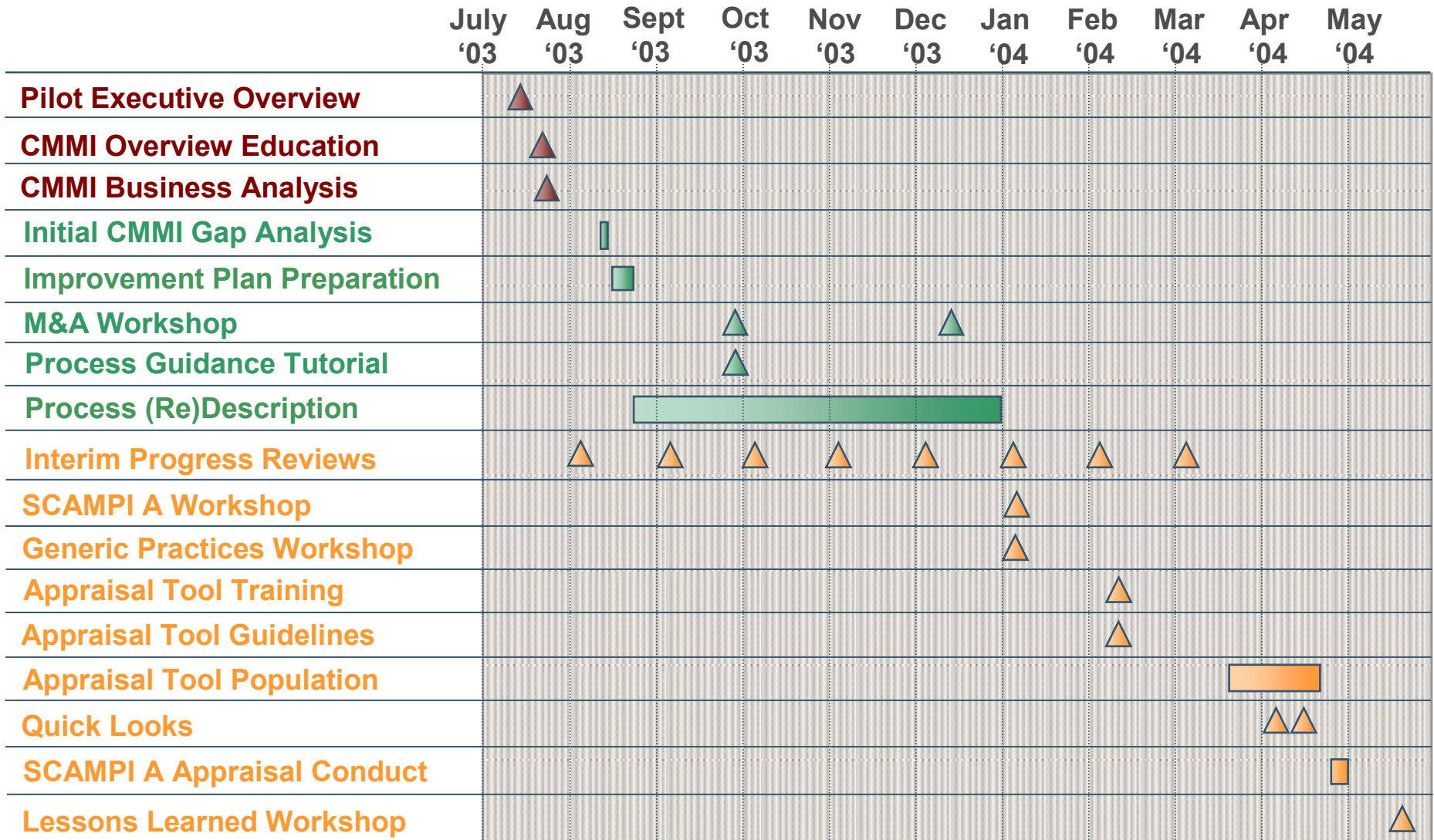
Selected 2 Pilot companies: Analytical Services, Inc. (ASI) and Cirrus Technology, Inc. (CTI)

- Presentation today focuses on ASI lessons learned

Pilot artifacts will be available at the SEI website by the end of the year
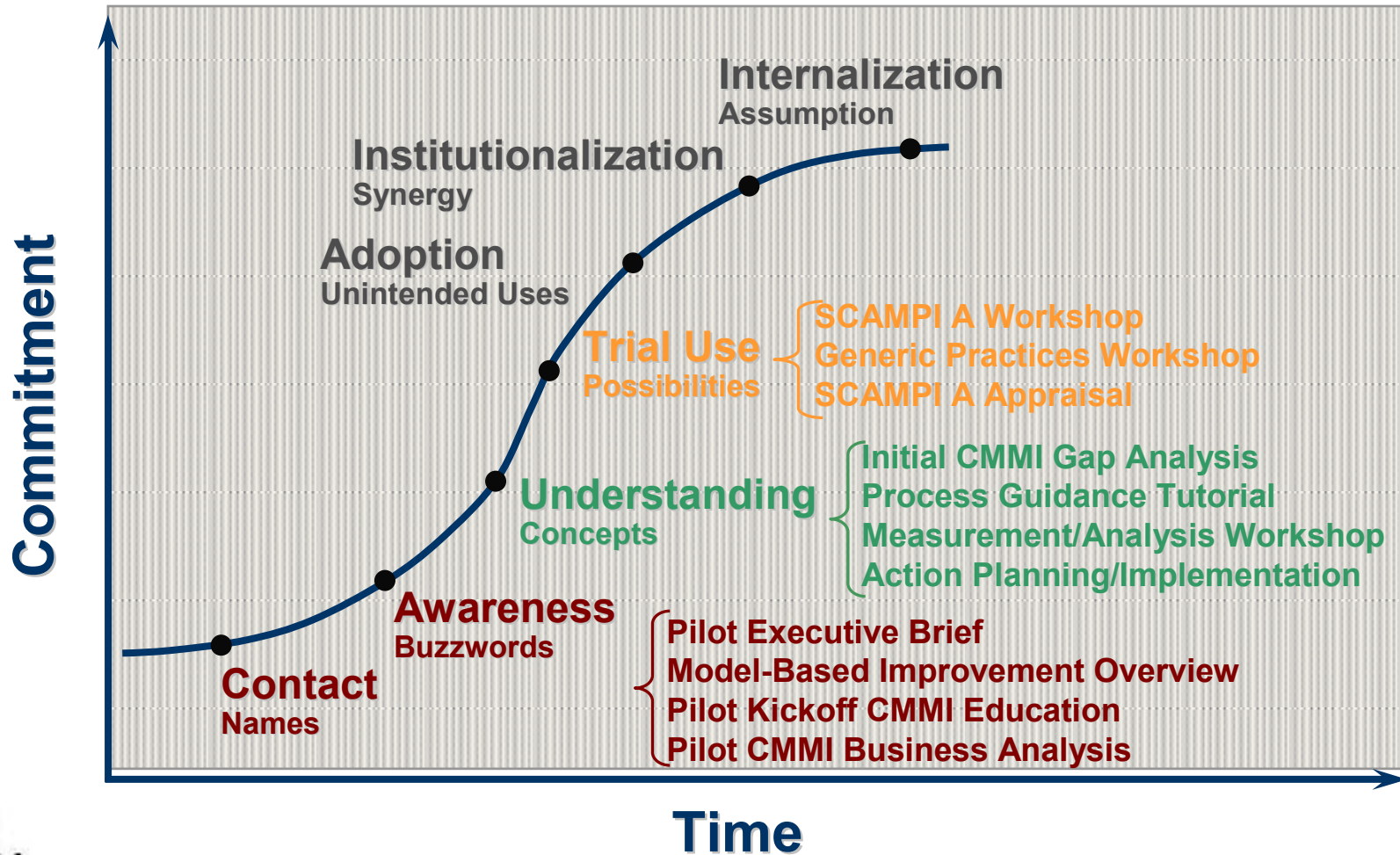
- Toolkit
- Experience reports (one for each company)

CMMI Small Business Pilot Schedule

	July '03	Aug '03	Sept '03	Oct '03	Nov '03	Dec '03	Jan '04	Feb '04	Mar '04	Apr '04	May '04
Pilot Executive Overview	▲										
CMMI Overview Education		▲									
CMMI Business Analysis		▲									
Initial CMMI Gap Analysis		▮									
Improvement Plan Preparation		▮									
M&A Workshop				▲		▲					
Process Guidance Tutorial				▲							
Process (Re)Description			▬▬▬▬▬▬▬▬▬▬▬▬								
Interim Progress Reviews		▲	▲	▲	▲	▲	▲	▲	▲		
SCAMPI A Workshop							▲				
Generic Practices Workshop							▲				
Appraisal Tool Training								▲			
Appraisal Tool Guidelines								▲			
Appraisal Tool Population										▬▬	
Quick Looks										▲▲	
SCAMPI A Appraisal Conduct											▮
Lessons Learned Workshop											▲

Legend: ■ Contact/Awareness   ■ Understanding   ■ Trial Use

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Summary of Materials Provided by Pilot

Commitment (y-axis) vs Time (x-axis)

Internalization
Assumption

Institutionalization
Synergy

Adoption
Unintended Uses

Trial Use
Possibilities
- SCAMPI A Workshop
- Generic Practices Workshop
- SCAMPI A Appraisal

Understanding
Concepts
- Initial CMMI Gap Analysis
- Process Guidance Tutorial
- Measurement/Analysis Workshop
- Action Planning/Implementation

Awareness
Buzzwords
- Pilot Executive Brief
- Model-Based Improvement Overview
- Pilot Kickoff CMMI Education
- Pilot CMMI Business Analysis

Contact
Names

Adapted from Patterson & Conner, "Building Commitment to Organizational Change", 1982.

Adoption of CMMI by ASI
and
Lessons Learned

Jack Conway

Vice President Systems Management

CMMI Pilot Project Coordinator

Analytical Services, Inc. Huntsville, Alabama

Company Profile
Analytical Services, Inc.

- Management and Technical Services Company
- Incorporated in 1992
- Hispanic, Woman-Owned, Small Disadvantaged Business
- ISO 9001:2000 Registered/Successful CMMI SCAMPI A Appraisal
- Top Secret Facility

Core Competencies

Information Technology

Systems Engineering/ Program Management

Engineering and Scientific Analysis

Professional and Organizational Development

Employee Growth 1995 - 2004

95	96	97	98	99	00	01	02	03	04
12	16	26	65	80	115	200	257	279	325

2004 Projected

Revenue Growth 1995 – 2004 ($M)

95	96	97	98	99	00	01	02	03	04
0.7	1.1	2.2	4.7	7.3	8.0	13.8	18.0	23.1	29.2

2004 Projected

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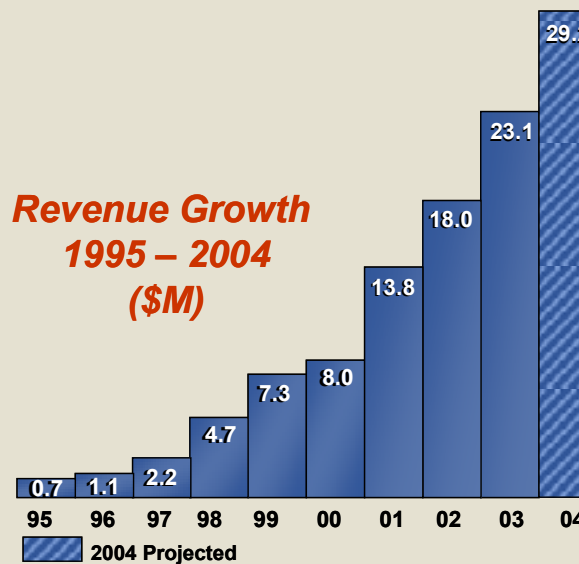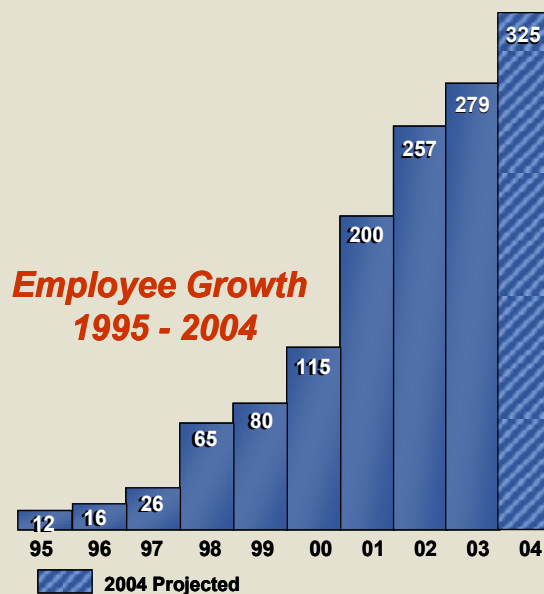
About ASI

- **Customer base:**
  - Army
  - Air Force
  - National Aeronautics and Space Administration (NASA)
  - Defense Information Systems Agency (DISA)
  - Defense Finance and Accounting Services (DFAS)
  - Missile Defense Agency (MDA)
  - Office of the Secretary of Defense (OSD)

2003 - NASA's Woman Owned Business of the Year

2002 - BBB Torch Award for Marketplace Ethics

2001 - National Minority Business of the Year by the U.S. Small Business Administration in Washington D.C.

ASI's Process Improvement History

Development of our Quality System

- Until '02, written corporate policies - few written processes
- 2002 - Began investigation of Quality Systems – ISO 9001-2000
  - Worked with consultants from local university
  - Mentor Protégé Program provided guidance
- Nov '02 – Mar '03 - Established Quality Management System (QMS)
- Feb '03 - Pre- Assessment NQA Audit (external)
- Mar '03 - External certification audit for ISO 9001-2000 Registration -NQA
- May '03 - Selected to participate in CMMI Small Business Pilot Project
- Jun '03 - ISO Audit - 3 Month Registration Surveillance Audit
- Aug '03 - Initiated CMMI Pilot Project – (Continuous Representation)
- Apr '04 - ISO Audit - 2nd Surveillance Audit
- Apr/May '04 - Completed Pilot - SCAMPI A Appraisal of **5** process areas.
  - Achieved Target Capability Level Profile
- Oct '04 - ISO Audit - Oct '04 - 3rd Surveillance Audit

ASI CMMI Adoption

- Selected to participate in CMMI Small Business Pilot Project – May '03

- Initiated CMMI Pilot Project – Aug '03
  - Project Planning (PP)
  - Requirements Management (REQM)
  - Measurement and Analysis (M&A)

- Completed Pilot in May '04 – Culminated with SCAMPI A Appraisal

- Appraisal of **5** process areas with addition of:
  - Organizational Training (OT)
  - Organizational Process Focus (OPF)

- Achieved Target Capability Level Profile
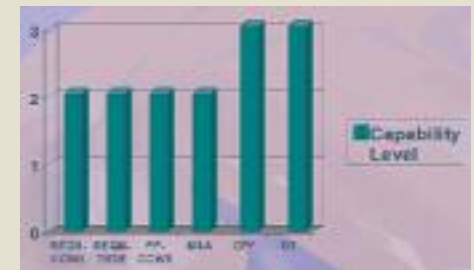
ASI Adoption Objectives

- Must be affordable!
- Fit with Quality Management System (QMS)
- Adopt without dedicated overhead
- Useful for mission objectives and customer work
- Non interference with customer projects
- Recognized by customers
- Benefits and measurable pay-off
- Achievable within time frame
- Broader application than just software
- Long term benefit
- Additional revenue

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Adoption Approach

Used for Pilot Project

- Assigned to single business unit with multiple direct customer programs.
- Focus on systems engineering and application development
- Multi-level team: technical, managers, quality coordinator and executive.
- Develop processes to address real situations, using real data
- Listen to the consultants!
- Experiment with tools offered.
- Action, action, action.
- Stay on schedule!
- Regular sessions – weekly phone cons/monthly sessions.
- Use action lists and minutes to hold ourselves accountable.
- Readjust when overcome by events.

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ASI Pilot Program

	Total	Team Mtngs.	Telecons	Process Develop	Training & Awareness	Implemen-tation	Appraisal Prep	Appraisal
Exec. Lead	286	96	80	40	24	10	20	16
PM	240	80	60	40	24	20	12	4
PM	252	96	80	40		20	12	4
SW Eng.	312	96	80	60		30	40	6
Prog Analyst	144	60	50	20		10		4
SW Developer	124	60	50			10		4
SW Eng.	134	80	50					4
QA	206	60	50		24		40	32
QA	50	30	20					
Prog Control	30					20	4	6
SW Developer	42				12	30		
Executive	76	35				33	4	4
Workforce	45	25						20
Total Hours	**1941**	**718**	**520**	**200**	**84**	**183**	**132**	**104**
% of Hours		**37%**	**27%**	**10%**	**4%**	**9%**	**7%**	**5%**
Total Cost	**$138,833**	**$52,219**	**$36,662**	**$15,621**	**$5,510**	**$13,348**	**$8,753**	**$6,719**
% of Cost		**38%**	**26%**	**11%**	**4%**	**10%**	**6%**	**5%**

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Benefits from CMMI Adoption

- Participation in Pilot extremely beneficial for ASI
- CMMI Adoption has been worth investment
    - CMMI adoption enhanced and improved our QMS
    - Natural follow-on to ISO and provides continuous improvement
    - Improved ability to organize and communicate status of projects to customers and other stakeholders
    - Addresses customer projects with processes
    - Reduced training time for new employee
    - Prevented requirements creep and ensured on-time and below budget project completion
    - Supports company objectives
    - Provides path for taking the company to the next level

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- Small Business needs to realize pay off quickly

- Customer driven requirements are significant (de)motivator

- Small businesses do not have staff dedicated solely to CMMI implementation – customer requirements take priority and can cause delays

- There is not a lot of functional organization to leverage from in a small business

- CMMI is easier to interpret for product development than for services – Small Businesses are typically more service oriented

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Lessons Learned –Small Business Implementation

- ISO 9001-2000 and CMMI can be compatible and complementary

- "The customer rules" – Many small organizations adopt/adapt business practices directly from their customers or primes

- State of company quality systems has major impact on implementation effort, for good or ill

- Less formal organizational structure means fewer barriers to "knock down"; leadership involvement is not difficult to obtain

- Just In Time Training is critical for small organizations

- Eliminating intimidation factor of CMMI is essential

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How Pilot Artifacts Can Help Small Businesses

Using CMMI in Small Businesses

- CMMI Provides a Set of Best Practices From Which Small Businesses Can Benefit

- The Continuous Representation of the CMMI Allows Small Companies to Focus on Improvements That Have the Highest Payoff for the Company

- Aligning Improvement With Business Goals Is Particularly Important for Small Businesses

- Simple CMMI-Based Improvements Can Have a Significant Impact in Small Organizations

- "Changing" the Practices Isn't Necessary in Most Cases; Finding Alternative Practices Is Often Relevant

- Both CMMI and SCAMPI A Scale Down to Fit Small Settings

✓ *The Greatest Challenge for Small Businesses Is the Affordability of Subject Matter Experts, and the Implementation and Appraisal Costs*

How the Pilot Artifacts Can Help Small Businesses

Three artifacts from the pilot will be available on the SEI website

- Toolkit
- 2 Experience reports

The CMMI for Small Business Pilot artifacts should prove useful in helping small businesses

- Focus their improvement efforts
- Figure out how and where to get started
- Tie their improvements to business goals
- Train their staff
- Realize payoffs early in the improvement
- Improve their ability to prepare for appraisals

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