

SPAWAR



Don't Bite the Whole Apple!

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Purpose

To provide guidelines for selection of Best Practices and Lessons Learned to improve the chance of software project success.



OUTLINE

- **Historical Perspective**
- **Identification of Main Problems**
- **Development of Solution Set**
- **Solution Selection**
- **Implementation**
- **End Results**
- **Lessons Learned**



Past History Shows.....

- **Only 16% Of Software Projects Are Expected To Finish On Time And On Budget⁽¹⁾**
- **Projects Completed By The Largest US Organizations Have Only 42% Of Originally Proposed Functions⁽¹⁾**
- **An Estimated 53% Of Projects Will Cost Nearly 190% Of Their Original Estimates⁽¹⁾**
- **In Large Companies, Only 9% Of Projects Will Be Completed On Time & On Budget⁽¹⁾**
- **Canceled Projects - \$81 Billion Loss to US in 1995⁽¹⁾**
- **Average MIS - 1 Year Late, 100% Over Budget⁽²⁾**

(1) Standish Group International Report: "Chaos", as reported in Open Computing. Copyright SPC

(2) Capers Jones, Applied Software Measurement, McGraw-Hill



The Defense Science Board Said (*over 10 years ago*)

“Today’s major problems with military software development are not *technical* problems, but *management* problems.”

[Defense Science Board Task Force on Military Software, executive summary.]

And after ten years it still holds true!



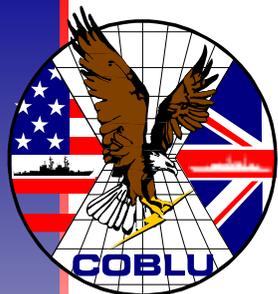
How Do We....

- **Define the main issues**
- **Prioritize the areas needing focus**
- **Establish criteria for selecting a solution set**
- **Measure effectiveness of changes implemented**

PMW-189 Experience



Our Mission



- **PMW 189 is responsible for development, production, and deployment of fleet cryptologic/signals intelligence/direction finding systems (5 ACAT III/IV programs, \$1.2 Billion budget in FYDP)**



- **Software is the backbone of the capability provided by PMW189**

- Complex, operationally demanding applications
- Historically software has been our “Achilles Heel”

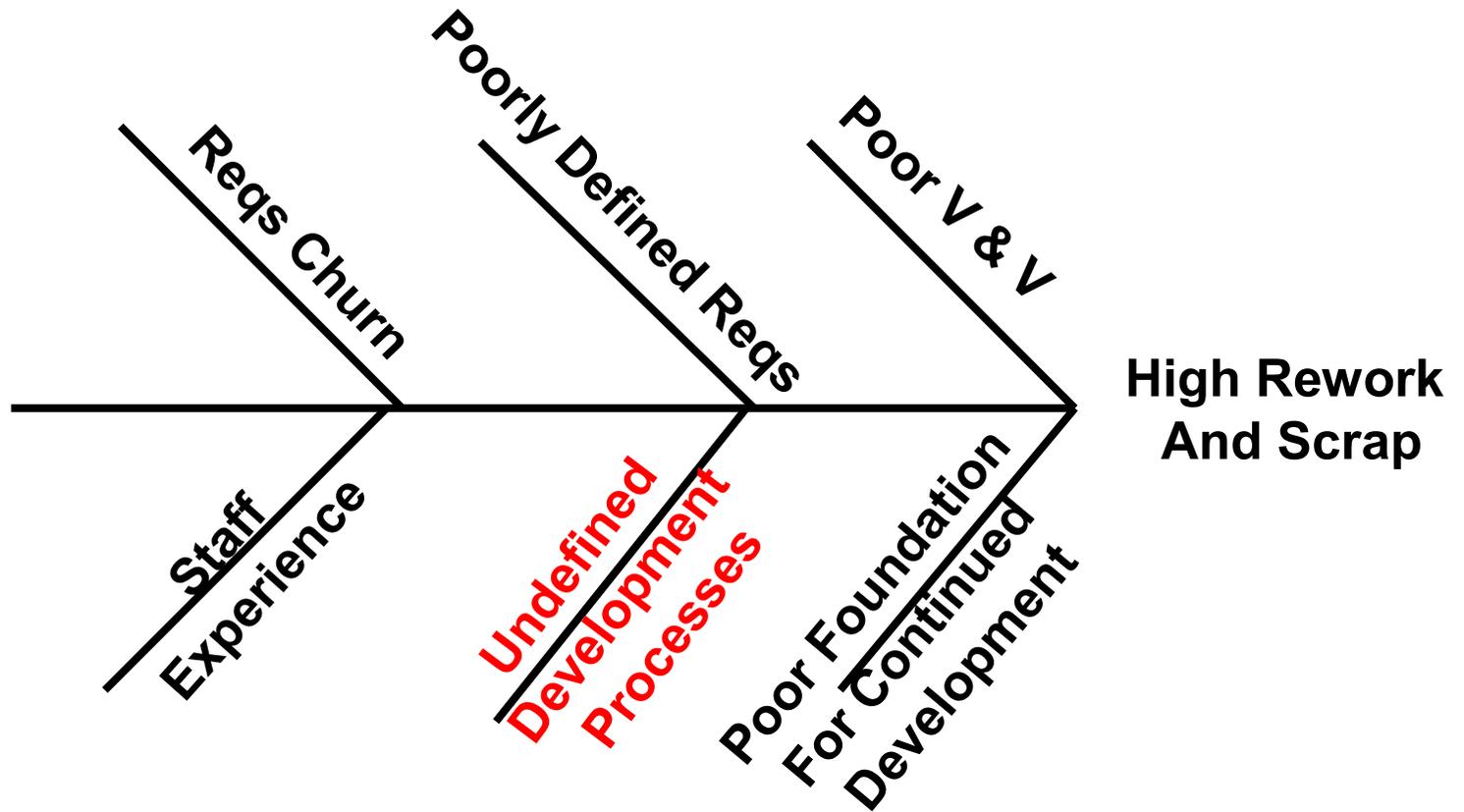




Prioritized Main Issues

- **Our programs have a high rate of rework and scrap**
- **Our products have numerous defects after delivery to the fleet user**
- **Seem to have difficulty in finding the right developer who can deliver a quality product**
- **We are reactive rather than proactive**

Cause and Effect



Phase One

**Focus on improving the
development and requirements
processes**



Phase One Implementation Strategy

- **Baseline current performance**
- **Focus on top risk items**
- **Select a maximum of four changes for simultaneous implementation within the program**
- **Motivate the entire team for implementation of the selected best practices**



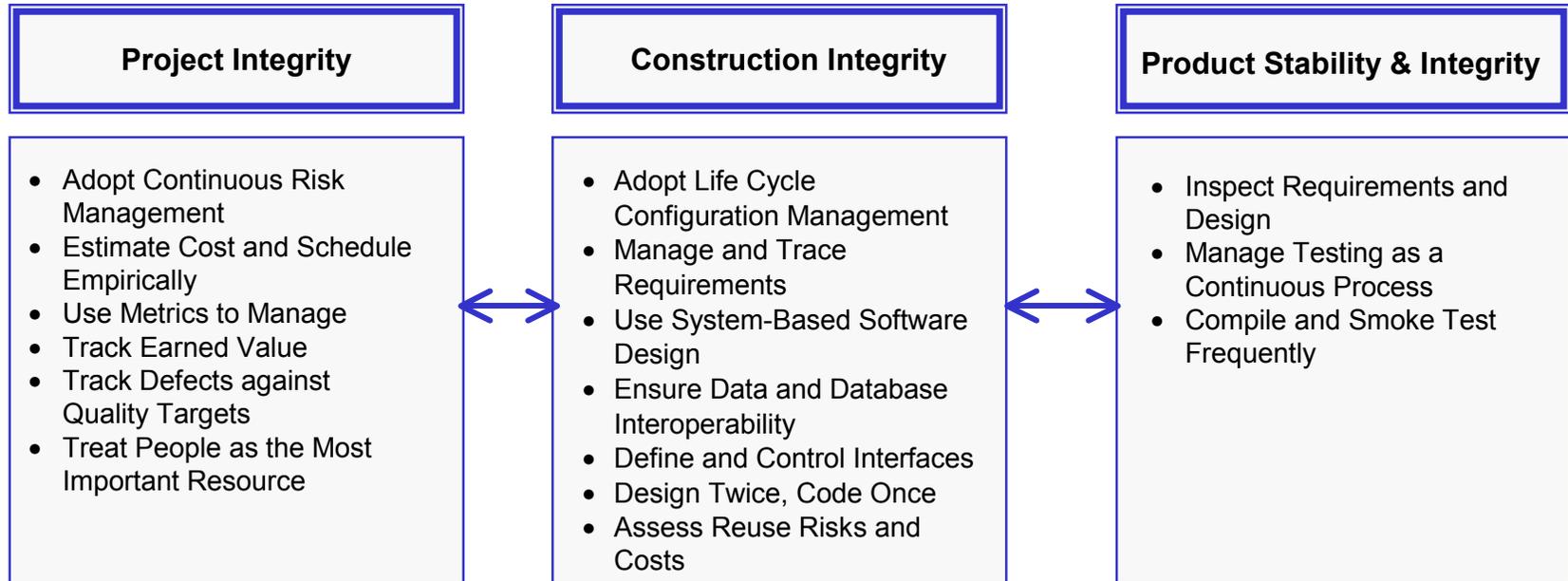
Baseline Current Product

- **Utilizing the Software Program Managers Network (SPMN) 16 Point Plan to:**
 - Assess program health and status
 - Realize true state of software processes
 - Identify top risks
 - Validate current schedules and estimates



Process Improvement Focus Was Implementation Of SPMN 16 Point Plan TM

16 Point Plan are 16 proven practices from industry & SPMN Airlie Council



- Incorporates proven commercial best practices
- Focuses on high-leverage, bottom line
- Brings big savings
- Uses flexible templates

- Not proprietary
- Specific
- Measurable
- Attainable
- Realistic
- Readily implemented



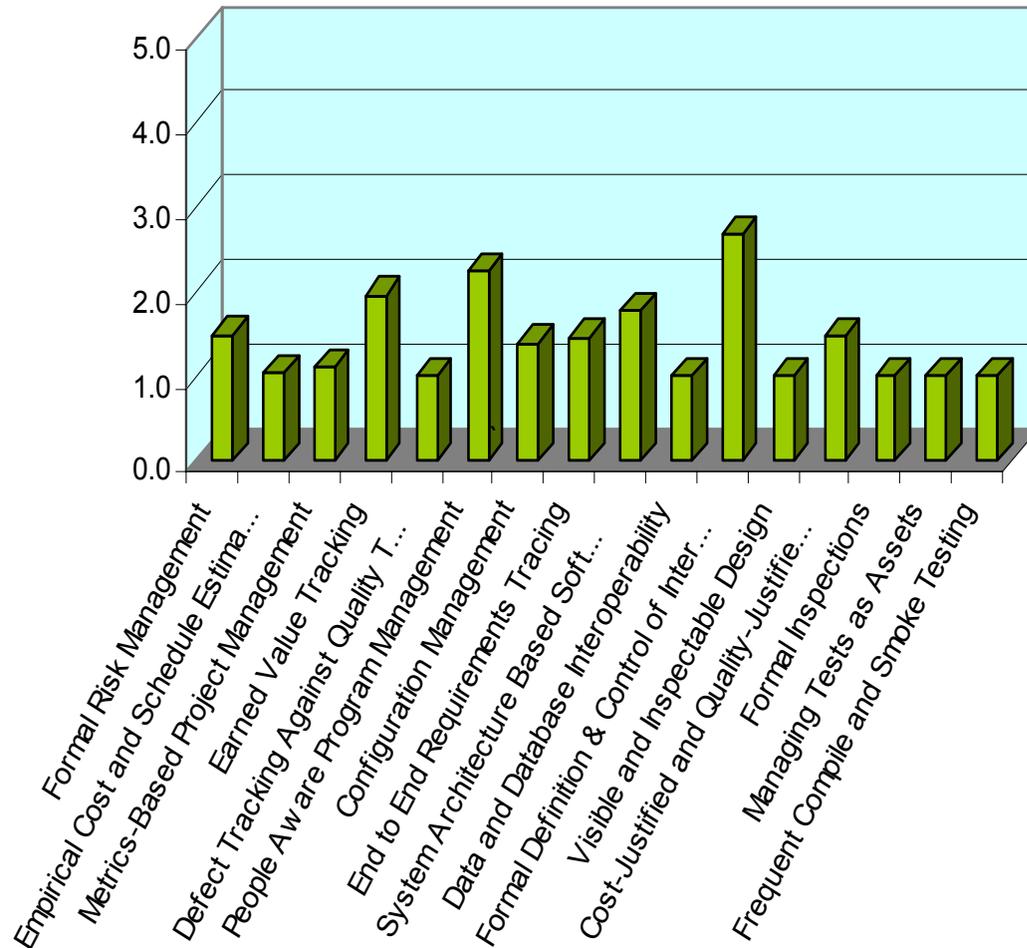
Baseline Process

- **First assessment was held at Program Office and was supported by the developer**
- **Utilized the ICE/SPMN tool and questionnaire**
- **Ratings based on the following scale:**
 - 1 = Component not evident
 - 2 = Respondent aware of requirement. Not yet implemented
 - 3 = Implementation under way. Not yet in place.
 - 4 = Implementation evident, but not effective
 - 5 = Effective implementation



First Assessment Results

16-Point Plan Assessment



Observations

- **Unwarranted optimism plagues the program**
- **Overall processes and requirements not defined**
- **Schedules and estimates did not have a firm basis**
- **Difficulties in understanding the impacts of process shortfalls**
- **Product functionality missing**

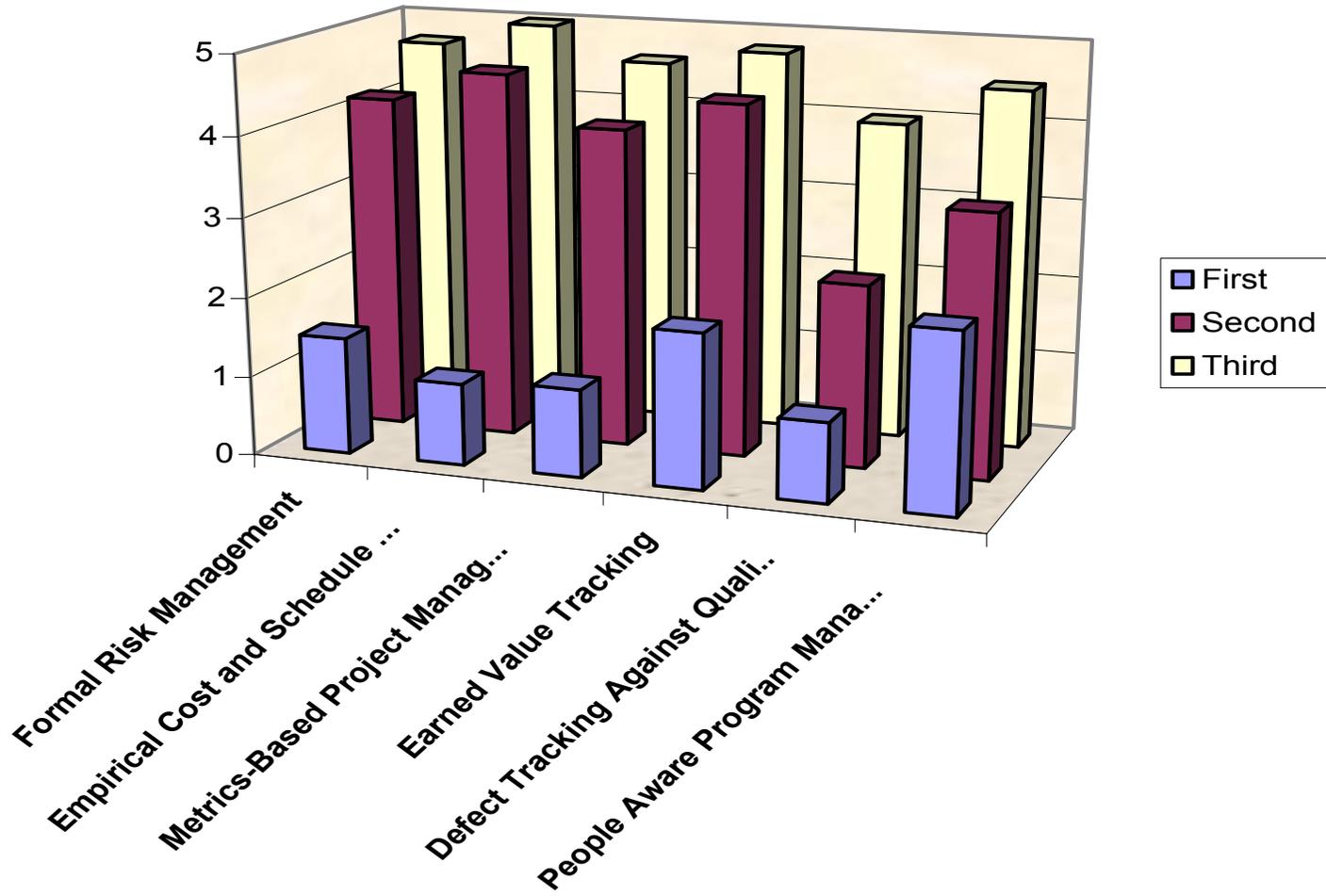


Subsequent Assessments

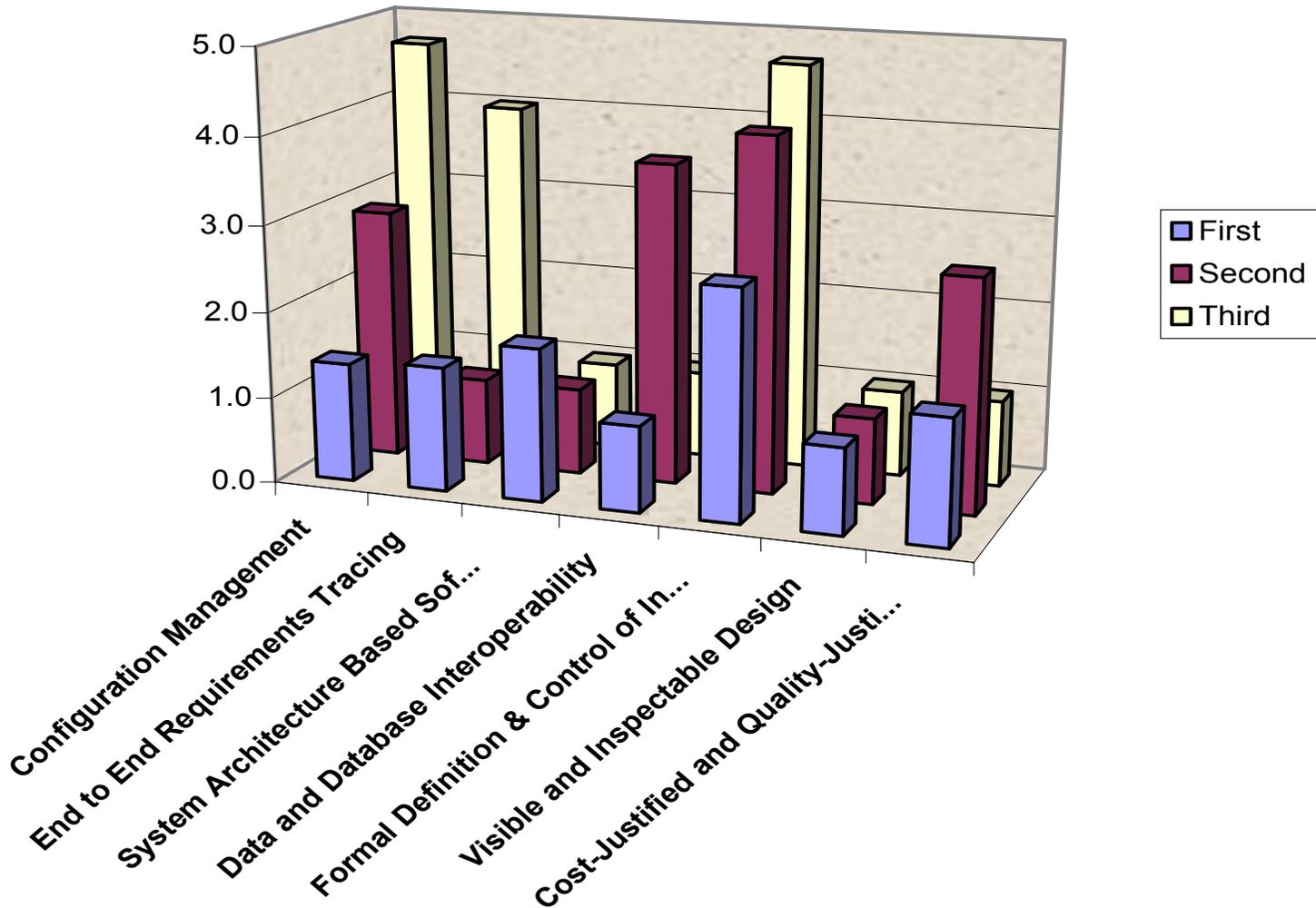
- **After baseline assessment, the contractor implemented changes in 12 of the 16 areas**
- **Teams were formed to work on assigned focus areas**
- **Risk Management was imbedded into daily business practices**
- **Two follow-on assessments were conducted at 4 month intervals to measure progress**



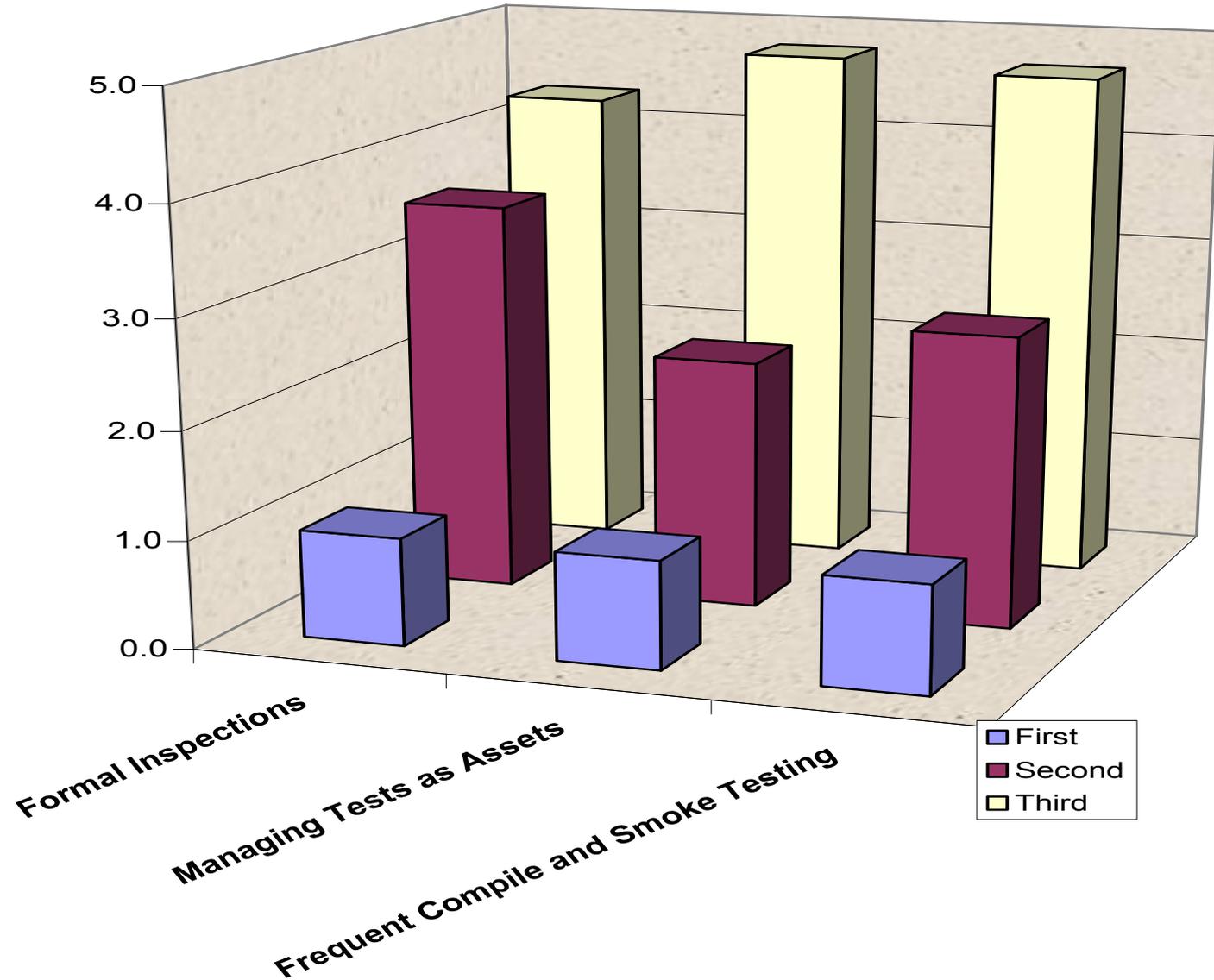
Project Integrity Summary



Construction Integrity



Product Quality





Did It Work ?

- **Significant improvements in**
 - Software durability
 - Software reliability
 - Training
 - Documentation
- **Cultural resistance diminishing**



Phase One Lessons Learned

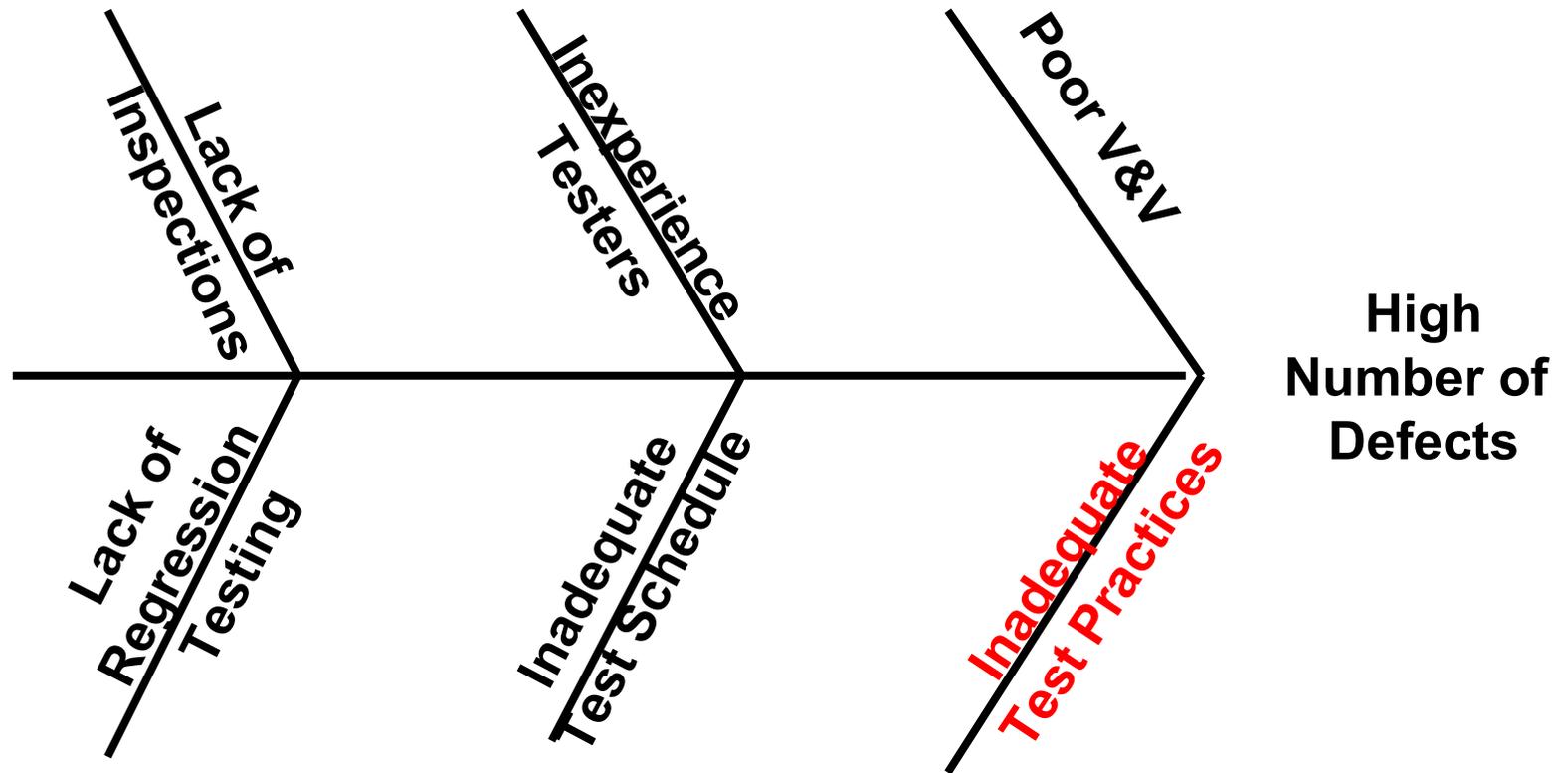
- **Keys to successful implementation - - top management leadership, training, and joint PMW, SSC and industry teaming**
- **Real pay-offs occur when risk mitigation is solved by prevention-based technical strategies**
- **Risk can be a guide to needed process improvement/application of Best Practices**
- **Can implement only 1-2 Best Practices at a time**
- **There is benefit in fostering an environment where everything is challenged**
- **Use of outside experts to assess risks is a good idea**
- **We want to repeat our successes - not our failures**



Priority Two Issue

**Our products have numerous defects
after delivery to the fleet user**

Cause and Effect



Phase Two

**Focus on product functionality,
reliability and test strategies**



Phase Two Prioritization

- **Phase Two prioritization**
 - **Near Term:**
 - Reliability Growth
 - Good Testing Practices
 - Mid-Term
 - Unwarranted Optimism
 - Accountability of Practices



Established a Working Group

- **Team members were experienced in software development practices and included an independent member**
- **Informally assessed test practices**
- **Identified issues and obstacles**
- **Defined issues**
- **Prioritized recommendations for near and mid term accomplishment**
- **Identified required resources for implementation**



Reliability Growth Plan

- **Near Term Recommendations**
 - Conduct an independent Pre-OPEVAL Assessment
 - Examine fault profiles
 - Establish a reliability improvement scale
 - Establish quality gates for each DT evolution
 - Conduct a team meeting with OPTEVFOR to review OT rules and how they will be applied to program



Reliability Growth Plan (cont'd)

- Establish a cut-off period for any future developments or ECPs and focus remaining time on building reliability
- Construct a “backwards” schedule to determine latest dates for corrective action
- Review defect tracking system and required metrics to determine discovery and correction rates
- Validate the test environment



Reliability Growth Plan (cont'd)

- **Mid-term Actions:**
 - Conduct end-to-end path testing
 - Expand white box testing
 - Conduct code end-to-end walkthroughs
 - Determine software reliability allocations for all subsystems
 - Conduct regression testing on each build

Words of Wisdom: “Being naïve and expecting this to be done by statistically unsophisticated people who can’t or won’t do the math in order to discover which caveats do and don’t apply in your case.”

Testing: Best and Worst Practices – A Baker’s Dozen by Boris Beizer



Test Practice Recommendations

- **Change test structure. Add enhanced negative testing and system level white box testing**
- **Enhance current regression test process**
- **Conduct path analysis and schedule testing to focus on the top 20% of paths utilized**
- **Complete a Pedigree Analysis**
- **Conduct Fagan Inspections on key threads/critical paths**

Words of Wisdom: “ Good testing practices can’t be defined by simple rules of thumb or fixed formulas. What is best in one circumstance can be worst in another.”

Testing: Best and Worst Practices – A Baker’s Dozen by Boris Beizer



Interim Results

- **Reliability Growth is the main focus**
 - 8% improvement in MTBOMF (sw)
- **Defect Discovery Rate**
 - More robust test environment
 - Seen a 48% increase in PCR's discovered within first month of implementation
- **Defect Removal Rate**
 - Closure rate is steady
 - Fix stage scheduled between major test events

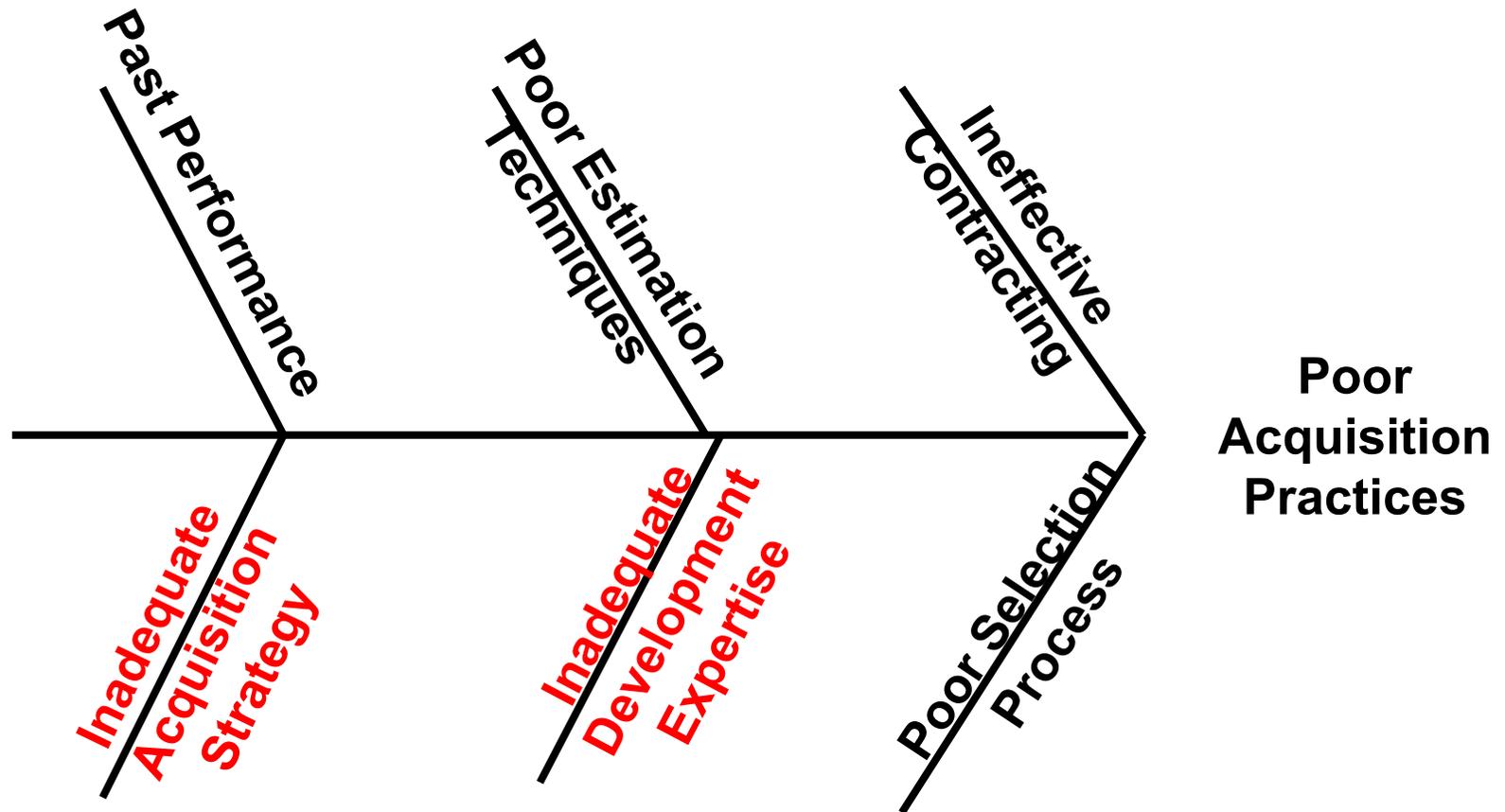


Priority Three Issue

Seem to have difficulty in finding the right developer who can deliver a quality product

We are reactive rather than proactive

Cause and Effect



Phase Three

Evolve the Program Office into a world class systems acquisition team by developing a strong software and hardware knowledge base.



What's Next?

- **Phase Three**

- Focus on required expertise to become a world class program office:
 - Expand knowledge base from hardware intensive to software intensive acquisition management
 - Institutionalize Risk Management across all programs
 - Continually measure performance against standards
 - Remove Crisis Management from program environments
 - Allow managers to focus on what they have to do; Not which fire has to be put out.
 - Build an environment of trust where potential problems can get a thoughtful analysis

Consider How Far We've Come!



**Strategic
Planning**

1998



**Risk
Management**



**Best
Practices**



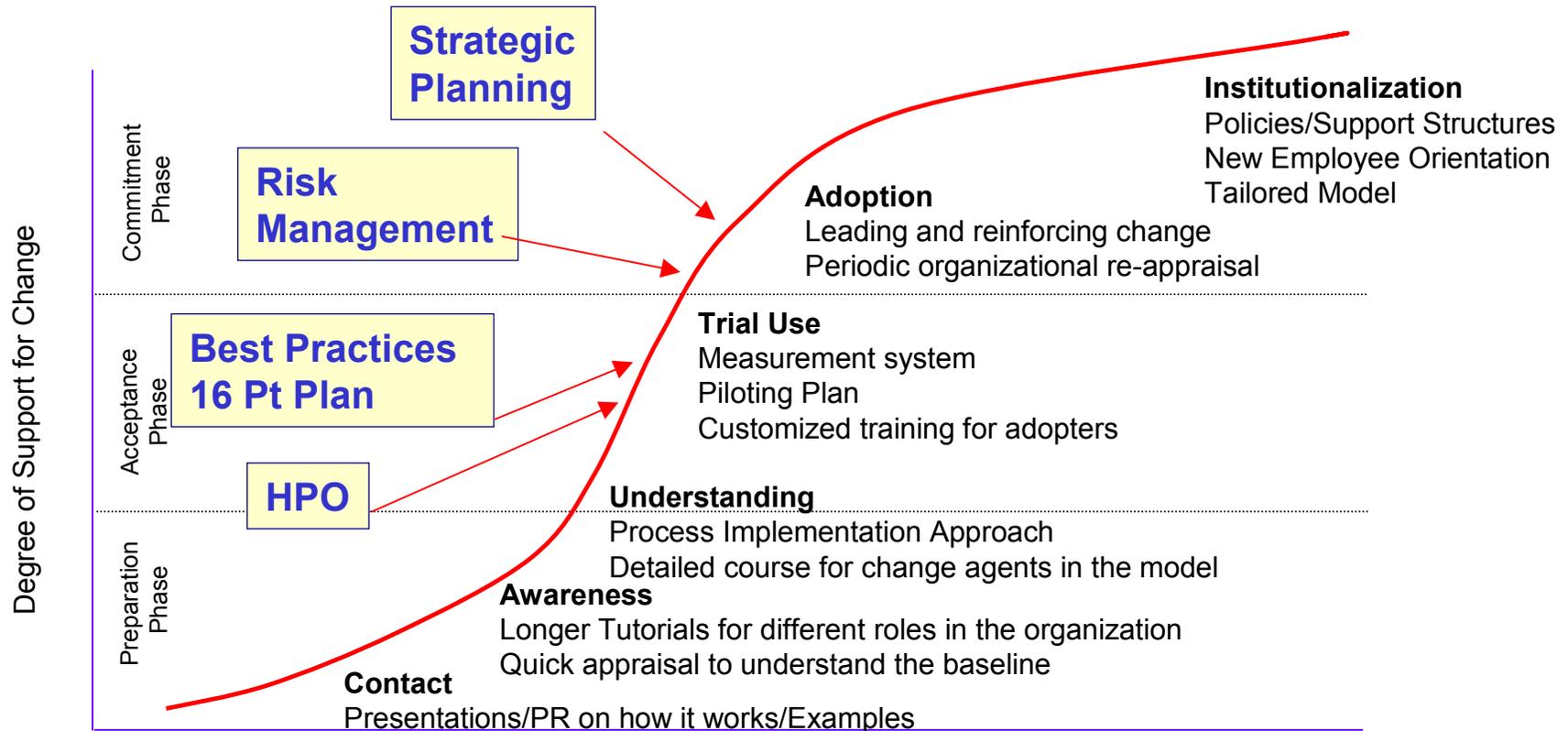
16 Point Plan



**HPO
2002**



Patterson-Conner Change Adoption Model



Garcia, Suzanne, *Are You Prepared for CMMI?*, CrossTalk, Mar 2002



Implementation Strategy

- **Assess and baseline acquisition performance based on SA-CMM and DoD instructions**
 - Identify deficiencies
 - Provide training
 - Reassess to monitor progress
 - Conduct gap analysis
- **Determine high risk areas and provide necessary training to construct a plan for corrective action**
- **Revitalize the risk management program**



Implementation Strategy

- **Establish a metrics IPT to provide performance measurements**
- **Employ a self evaluation program**
- **Put into practice the transition mechanisms required to proceed to the next level of excellence**



Lessons Learned

- **Develop a potential solution set by analyzing cause and effects**
- **Select two process improvements which are in alignment with top risks, resource availability, and team capabilities**
- **Apply a structured approach in increments that are attainable and measurable**
 - “short term wins” to build enthusiasm and commitment to change
 - ROI



Lessons Learned

- **Measure your progress incrementally and continue to refine your best practices.**
- **Broaden your application after you have proven the concept**
- **Select the next two improvements and begin the cycle again.**



Lessons Learned

- **Bottom line:**
 - Start small, adopt a process, implement the strategy and continually refine.
 - Don't become discouraged if improvements are not realized immediately.
 - Get total commitment from every member of the team.
 - Mature your environment and processes in parallel to obtain institutionalization.
 - Employ **leadership** which creates an environment that is conducive to change and maintains a vigilant focus!

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