The Problem with Problem Management

Evaluating the Systems Engineering Problem Management Process for Heavy Industrial Manufacturing Problems

Dennis A. Perry, III
Bill Olson, Ph.D.
Paul Blessner, Ph.D.
George Washington University

This research is performed for The George Washington University in partial fulfillment of the requirements for the Doctor of Philosophy degree.
Introduction

• Problem Management is not covered in INCOSE SE Handbook
  – Yet problems exist in any project
• Systems Engineering Problem Management Process (SEPMP)
  – Modeled after Risk and Opportunity Management methods
  – Shall be included in the Project Systems Engineering Management Plan (SEMP)
Risk, Project, & Problem Management

- Systems Engineering
- Risk Management & Systems Engineering
- Risk Management History
- Risk Management Process Improvement
- Risk Management & Project Management
- Systems Engineering Problem Management
- Risk Management & Problem Management
SEPMP - Components

- Identification
- Assessment
- Investigation
- Action Planning

- Reporting
- Closure
- Knowledge Management
# Problem Management Models

<table>
<thead>
<tr>
<th>Factors</th>
<th>Subfactors</th>
<th>Variables</th>
<th>SE Problem Management Model</th>
<th>Porter's Five Forces Model</th>
<th>Taylor's IT Problems Model</th>
<th>Weber &amp; Konsynski's DSS Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Management</td>
<td>Planning</td>
<td>Resources</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tools</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identification</td>
<td>Risks</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emergent</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analysis</td>
<td>Impact</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timeliness</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Handling</td>
<td>Design</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Implement</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monitoring</td>
<td>Reporting</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Validation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Closure</td>
<td>Close Problem</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lessons Learned/KM</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Problem Management Models

## Problem Management Models

<table>
<thead>
<tr>
<th>Factors</th>
<th>Subfactors</th>
<th>Variables</th>
<th>SE Problem Management Model</th>
<th>Porter's Five Forces Model</th>
<th>Taylor's IT Problems Model</th>
<th>Weber &amp; Konsynski's DSS Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Technical</td>
<td>Validation</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verification</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Schedule</td>
<td>Key Events</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Completion</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Cost</td>
<td>Budget</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Safety</td>
<td>Project</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Product</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
<td>Regulation</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Community</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Programmatic</td>
<td>Events</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>People</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
SEPMP – Problem Identification

• Planning for Problems
  – Thresholds
• Process Failures
  – Accidents
• Risk
  – Likelihood 100%
• Communication
• Customer Feedback
Problem, Risk, or Crisis?

- Is a Problem just a Risk to a future step in the value stream?
- What is a Crisis?

Problem Identified for Key Event B?

OR

Risk Identified to Key Event C?
SEPMP Analysis – Impact

• Impact of the problem if not addressed
• Categories of Problem Impacts
  – Technical
  – Cost
  – Schedule
  – Safety/Environmental
  – Programmatic

Is this a comprehensive list?
SEPMP Analysis – Timeliness

• For any given deadline, the later a problem is identified, there is less time to:
  – React
  – Plan
  – Analyze
  – Resolve
  – Avert Disaster!

Is this Self-Evident?
SEPMP – Problem Assessment

Problem Matrix

<table>
<thead>
<tr>
<th>Impact</th>
<th>Critical</th>
<th>Serious</th>
<th>Noteworthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeliness</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Problem with Problem Management
SEPMP – Problem Handling

Methods or Tools
• Acceptance
• Avoidance
• Transference
• Resolution

How do these relate to the INCOSE SE process?
• Requirements
• Validation
• Risk
• KM
SEPMP – Monitoring and Closure

• Monitoring
  – Maintain awareness of problems
  – Consider established thresholds
  – Problems as liabilities

• Closure
  – Decision support criteria
  – Cost effective to manage
  – Departure from specification
  – Absorb impact
SEPMP – Knowledge Management

• Cross Program Liabilities
• Lessons Learned
• Hotwash for Significant Problems
• SEPMP feeds KM tool
• SEPMP considers KM
  – During identification, analysis, and assessment

How helpful is it as a tool for identifying systemic issues?
Research Model

• Mixed Method approach
  – Empirical analysis of existing problem and risk data
• Data from multiple programs
  – Impacts project success at completion and milestones
• Data from a 3 year period
• Differing impact magnitudes
  – Effort required to manage the problem

Can the SEPMP allow for Scalability?
Data Collection

• Full Study
  – Sample of approximately 300 problems
  – Multiple programs
  – Includes customer- and self-identified problems
• Significant data mining required
• SME interpretation for some variables
Independent Variables

- Impact – Harmful results of problem
- Impact communicated – how well the impact was characterized
- Timeliness – time to next milestone
- Timeliness communicated – how well the urgency was communicated
- Problem complexity – number of problem components and causes identified
- Actions – number of short and long term corrective actions
- EH&S – environmental, health, and safety impacts identified
- Impact Category – Technical, Programmatic, Safety, Cost, Schedule
- Similar Problems – Identified related problems
Dependent Variables

• Recurrence – Recurring problems of a similar nature
• Delay to Milestone – Every lost day can be costly
• Process Improvements – Resulting improvements from problem management
• DFS – Number of Departures from Specifications required to meet milestones
• Problem Management Cost – Time and Effort required to investigate and manage the problem
Hypotheses

• Increased attention to impact and timeliness will contribute to more effective problem resolutions
• Timeliness will be the primary driver to the quickness of the resolution
• The impact categories will adequately capture all problem impacts observed
• Existing KM will not support effective identification of Systemic issues
• Integration with Risk Management will be inconsistent
Recommendations

• Scalability
• Identification of systemic issues
  – Across programs
• Strengthen problem identification and characterization
  – Risk/Problem/Crisis relationships
• Problem Planning
  – Organizational decisions vs. project decisions
Recommendations for Problem Research

• Complete Study
  – Recommend improvements to SEPMP for heavy industrial manufacturing problems (6 months)

• Implement optimized SEPMP at Heavy Industrial Manufacturing Company (+1 years)
  – Case study after implementation (+2 years)

• More empirical research and case studies on SEPMP in other applications (+1-4 years)

• Establish confidence in SEPMP and include in INCOSE handbook as a standard SE tool (+5 years)
References

Dennis A. Perry, III, Author

Dennis Perry graduated from Virginia Commonwealth University in 1996 with a Bachelor of Science in Psychology, and again in 2000 with a Bachelor of Science in Mechanical Engineering while working as a retail sales manager in a furniture store. After 3 years as a sales engineer, Dennis joined Northrop Grumman Shipbuilding (now Newport News Shipbuilding, a division of Huntington Ingalls Industries) as a Systems Test Engineer. Dennis completed a Masters in Engineering Management at Old Dominion University in 2007. In 2010, Dennis transferred to Systems Engineering, and later assumed the CVN78 Configuration Management Lead position. In 2013, Dennis transferred to Program Quality Assurance as a senior quality engineer. Dennis lives in Williamsburg, VA, with his wife, son, and daughter.
Bill Olson, Ph.D., Co-Author

Bill Olson is the Leading Risk Manager for all special projects, in Huntington Ingalls Newport News Shipbuilding, Newport News, VA. He is a Certified Systems Engineering Professional and Defense Acquisition Specialist. He earned a Bachelor’s in Electronics from Chapman University (1984), a Masters in Program Management from Florida Institute of Technology (2004) and Ph.D. Systems Engineering at The George Washington University (2012). Currently, he is a Professorial Lecturer, Department of Engineering Management and Systems Engineering, The George Washington University. He has extensive experience in Systems Engineering. Bill Olson retired from the U.S. Navy as a Master Chief Petty Officer after proudly completing 25 years of active duty service.
Paul Blessner has 30+ years of experience in Manufacturing/Test/Quality/Reliability Engineering within the computer, aerospace and defense industries. His educational background includes Electrical Engineering (B.S., University of Nebraska), Business Administration (MBA, University of Colorado-Colorado Springs), Applied Statistics (M.S., Rochester Institute of Technology), and Systems Engineering (Ph.D., George Washington University). As a certified Six Sigma Master Black Belt, he has been actively engaged as a Six Sigma practitioner, trainer, leader and implementer. He has achieved certifications as a Quality Engineer, Reliability Engineer, and Quality Manager. Currently, he is a Professorial Lecturer of Engineering Management and Systems Engineering at George Washington University.
Contact Information

• Dennis A. Perry, III
• 757-345-3458
• George Washington University
• dap@gwmail.gwu.edu