Assuring Mission Success in Complex Settings

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SEI MOSAIC: Managing for Success

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Managing Complexity

Managers are responsible for overseeing increasingly complex projects, programs, and operational processes.

- Multiple points of management control
- Complex tasks
- Complex, distributed support technologies
- Multiple, detailed status reports
- A variety of management techniques (project, security, financial, technology, etc.)
- Requirements of multiple stakeholders
Need for a New Approach

Traditional analysis and management approaches not designed for complex environments

- Cannot handle organizational and technological complexity
- Do not easily scale to distributed environments

Need new methods, tools, and techniques to

- Position projects, programs, and processes for success
- Establish and maintain confidence in achieving objectives
Managing for Mission Success

Managing for mission success requires establishing and maintaining a reasonable degree of confidence that a mission’s objectives will be successfully achieved.
SEI MOSAIC:
Managing for Success
Overview

SEI Mission-Oriented Success Analysis and Improvement Criteria (MOSAIC) is a structured decision-making approach that

- Establishes a reasonable degree of confidence in the potential for a successful mission
- Helps ensure mission success in projects, programs, processes, and systems
Strategic Allocation of Resources

People need a way to make appropriate tradeoffs among a broad range of factors.

- Performance
- Interoperability
- Safety
- Quality
- Security
- Dependability

Broad Tradeoff Space
SEI MOSAIC: A Lifecycle Approach

Perform during any lifecycle phase

Supports most system lifecycle models
Managing the Outcome

An outcome is the result achieved when executing a mission.

- A range of potential outcomes is possible
- Some outcomes are acceptable—success
- Some outcomes are unacceptable—failure

SEI MOSAIC defines an approach for managing the expected outcome in relation to the desired outcome.

- What is the mission likely to achieve?
- What do I want the mission to achieve?
Range of Potential Outcomes

Current Conditions

Mission Activities

Potential Events

Range of Potential Outcomes

1 2 3 4 5
Positioning for Success

A range of outcomes is possible for any given mission.

Conditions and potential events

- affect mission execution and influence a mission’s eventual outcome
- must be appropriately managed to position a mission for success

The objective is to drive the expected outcome toward acceptable states.
## Unique Features of SEI MOSAIC

<table>
<thead>
<tr>
<th>Traditional Risk Management</th>
<th>SEI MOSAIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow scope</td>
<td>Broad scope</td>
</tr>
<tr>
<td>(single project, system, or organization)</td>
<td>(distributed processes, systems of systems)</td>
</tr>
<tr>
<td>Linear view of risk</td>
<td>Interrelated view of risk</td>
</tr>
<tr>
<td>(cause-effect pairs)</td>
<td>Outcome-driven</td>
</tr>
<tr>
<td>Threat-driven</td>
<td>Opportunity seeking</td>
</tr>
<tr>
<td>Hazard avoidance</td>
<td>“Playing to win”</td>
</tr>
<tr>
<td>“Playing not to lose”</td>
<td></td>
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</tbody>
</table>
Characteristics of Current Approaches

A prevalence of one-size-fits-all analysis and management methods

- Complex solutions that are not easily tailored (especially to small organizations)
- Tied to specific domains or problems

Locally optimized results

- Narrow tradeoff space
- Subset of the lifecycle
- Narrow scope (e.g., single project, system, or organization)
SEI Mosaic Approach

Each SEI Mosaic method is tailored to

- A given situation, problem space, or lifecycle phase
- The domain or application area
- The circumstances at hand

SEI Mosaic is focused on global effectiveness and mission success.

- Broad tradeoff space
- Lifecycle focus (development and operations)
- Broad scope (e.g., distributed processes, supply chains, systems of systems)
SEI MOSAIC Toolkit

Military and Defense  Financial Sector  Medical Sector  Complex Missions

Strategy Evaluation  Design Planning  Testing/Integration  Operations/Maintenance

Concept Exploration  Requirements Analysis  Development Activities  Release/Production
Our current work is focused on developing a suite of analysis methods.

Two methods so far:

- **Mission Diagnostic** is a basic approach that provides a quick, high-level evaluation.
- **Mission Assurance Analysis Protocol (MAAP)** is a comprehensive approach that provides an in-depth evaluation.
Mission Diagnostic

What
A time-efficient means of assessing the potential for success

Why
To determine whether conditions are favorable for a successful outcome

Key Results
An evaluation of key indicators and an estimate of the success potential
Key Indicators

Evaluate a set of indicators representing key aspects of management, for example:

- Realistic goals
- Customer requirements
- Staffing requirements
- Technology feasibility
- Plans and schedules

“Are customer requirements and needs well understood?”
### Evaluating Key Indicators

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Are goals realistic and well articulated?</td>
<td><img src="#" alt="Question/Answer" /></td>
</tr>
</tbody>
</table>

Each indicator is evaluated based on the data that have been collected.

Uncertainty is incorporated into the range of answers for each indicator.
# Indicator Evaluation Criteria

<table>
<thead>
<tr>
<th>Answer</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>The answer is almost certainly “yes.” Very little uncertainty exists.</td>
</tr>
<tr>
<td>Likely yes</td>
<td>The answer is most likely “yes.” However, a degree of uncertainty exists.</td>
</tr>
<tr>
<td>Equally likely</td>
<td>The answer is just as likely to be “yes” or “no.” A high degree of uncertainty exists.</td>
</tr>
<tr>
<td>Likely no</td>
<td>The answer is most likely “no.” However, a degree of uncertainty exists.</td>
</tr>
<tr>
<td>No</td>
<td>The answer is almost certainly “no.” Very little uncertainty exists.</td>
</tr>
</tbody>
</table>
Indicator Analysis

A simple analysis provides insight into a mission’s health.

Yes
Likely yes
Equally likely
Likely no
No

Indicator 1
Indicator 2
Indicator 3
Indicator 4
Indicator 5
Indicator 6
Indicator 7
Indicator 8
Indicator 9
Indicator 10

Uncertainty Line
Managing the Potential for Success

The goal is to improve a mission’s current state of health.
Indicators for Software Development Programs

- Are goals realistic and well articulated?
- Are communication and information sharing about mission activities effective?
- Are customer requirements and needs well understood?
- Are stakeholder politics or other external pressures minimal?
- Does the process design support efficient and effective execution?
- Are process control mechanisms are effective?
- Is task execution efficient and effective?
- Are staffing and funding sufficient to execute all mission activities?
- Are the technological and physical infrastructures adequate to support all mission activities?
- Are changing circumstances and unpredictable events effectively managed?
Evaluating Indicators

The following data are recorded for each indicator:

- **Indicator score**
- **Rationale for indicator score**
- **Analysis approach** (for example, intuition, qualitative analysis, quantitative analysis, other)
- **Potential actions**
- **Evaluators**
- **Date**
Mission Diagnostic Exercise and Handout
Tailoring Questions

The following questions can be used when tailoring or developing a set of indicators:

- What constitutes a successful result for the project or process?
- What constitutes an unsuccessful result, or failure, for the project or process?
- What circumstances or conditions tend to produce a successful outcome when conducting the project or process?
- What circumstances or conditions tend to produce an unsuccessful outcome, or failure, when conducting the project or process?
Mission Diagnostic Across the Lifecycle

How much uncertainty in these indicators can you tolerate at different points in the lifecycle?
MAAP

What
A systematic approach for thoroughly analyzing the potential for success

Why
To characterize the full range of drivers affecting the success potential

To set management priorities to ensure the success potential is maintained within tolerance

Key Results
An operational model, customized analysis artifacts, a measure of the success potential, and strategies for keeping the success potential within tolerance
Operational Model of Mission Activities
Drivers of Success and Failure

A broad range of drivers must be considered when analyzing the potential for mission success.
A mission threat is a fundamental flaw, or weaknesses, in the purpose and scope of a work process.
A design threat is an inherent weakness in the layout of a work process.
Activity Management

An **activity threat** is a flaw, or weaknesses, arising from the manner in which activities are managed and performed.
Operational Environment

An environment threat is an inherent constraint, weakness, or flaw in the overarching operational environment in which a process is conducted.
An event threat is a set of circumstances triggered by an unpredictable occurrence that introduces unexpected change into a process.
Scenario-Based Analysis

Scenario 1
Expected operational conditions

Scenario 2
When stressed by Event 1

Scenario 3
When stressed by Event 2

Outcome during expected operational conditions

Outcome resulting from Event 1

Outcome resulting from Event 2

Expected outcome
Complex Risks

- IR team has too many tasks relative to number of staff
- All security events go to IR team
- Training is informal and based on mentoring
- IDS tools provide false positives
- IDS tools inherently provide false positive
- Inadequate and inefficient tuning of IDS tools exacerbates false positives
- IR team is bottleneck
- Inadequate staffing
- Limited backup capability for IDS tuning
- Inadequate training program
- Watch Office staff have uneven skills for recognizing false positives
- False positives could be forwarded by Watch Office
- Limited time and opportunity to stay current
- Heavy reliance on on-the-job training
- Reliance on pre-existing KSAs
- Best person for job not always selected
- Understaffing could lead to quality and response time problems
- Insufficient tools to support IR tasks
- Inadequate equipment for online training
- Lack of comprehensive, cross, and QA training
- Best person for job not always selected
- Sites don’t notify CIRC when performing internal scans
- False positives could be forwarded by Watch Office
- Events could be escalated unnecessarily by Call Center
- Difficult to find qualified staff
Outcome Analysis

The goal is to ensure that the expected outcome for each objective in all evaluated scenarios is acceptable to key stakeholders.

Best Outcome

Worst Outcome

Success threshold for cost

Gap between current and desired states for cost

<table>
<thead>
<tr>
<th>Objective</th>
<th>Best Outcome</th>
<th>Worst Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td></td>
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</tr>
<tr>
<td>Schedule</td>
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<tr>
<td>Cost</td>
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<td>...</td>
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Unique Features of SEI MOSAIC

- Manages the potential for success
- Can be applied to highly distributed programs and operational processes
- Provides a ‘global’ view of a mission
- Analyzes issues that are too complex for other techniques
Potential Application Areas

- Large, distributed software development programs
- Organizations in dynamic, rapidly changing business environments
- Organizations with strict reliability, security, and safety requirements
- Large, distributed supply chains
- Processes supporting critical infrastructures
- Distributed information-technology (IT) processes
Future Research and Development

Refine the current SEI MOSAIC analysis protocols.

Define and pilot additional SEI MOSAIC analysis protocols.

Begin work on an approach for real-time monitoring and management of mission outcomes.