SAND2017-9974PE



Integrating Systems Engineering, Project Management, and Quality Management

National Security Programs Mission Assurance Framework

Ann Hodges, Distinguished Staff Member, CSEP, SAFe SPC4

INCOSE Enchantment Chapter

September 22, 2017

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

What is Mission Assurance? DoD's Definition

An activity that "exploits multiple overlapping programs that operate cohesively to ensure organizational processes are performed in accordance with the intended purposes or plans. It includes activities and measures taken to increase resiliency of essential capabilities and supporting infrastructure required for the DoD to carry out the National Military Strategy."[1]

[1]US Department of Defense. 2013. "What is Defense Critical Infrastructure Program?" Accessed 1 March. http://dcip.dtic.mil/whatIsDCIP.html

What is Mission Assurance? SNL NSP Program Management Unit's Definition

The NSP PMU's definition of Mission Assurance (MA) is consistent with DoD's MA goal of successful mission support, but provides more specificity

- MA is the disciplined integrated application of program/project management (PM), quality management (QM) and systems engineering (SE) for the purposes of
  - delivering quality products and services to our customers to achieve mission success, and
  - provide management clear insight into the health of the project

Mission Assurance Framework Definition

Sandia National Laboratories

- Supports the application of MA
  - Guidelines
  - Requirements
  - Procedures
  - Graded approach determination
  - Project MA planning templates
  - Examples
  - Consulting/strategic placement

Motivation for MA Framework Sandia National Laboratories

- Sandia National Laboratories (SNL) is a government-owned, contractor operated facility
- National Security Programs (NSP) Program Management Unit (PMU) within SNL
  - Provides technological solutions for global security
  - Focused on engineering and integrating advanced science and technology
  - Work spans from basic research to operational system development and operations
  - Customers demanding a higher level of quality assurance and discipline
- Sandia
  - Level 4 manager (VP) supported Mission Assurance (MA) for his program portfolio
    - Motivated by past near misses (“can’t manage out of a paper bag”) and successes (Sponsor evaluations of “best of breed”)

Motivation for MA Framework Sandia National Laboratories

Sandia National Laboratories

- We deliver significant, innovative, and unique products and services to our customers. However, these high-quality deliverables are produced sometimes only through heroic efforts.
- We are not able to demonstrate a disciplined approach by which defined quality standards and methodologies are consistently applied.
- Quality expectations are not uniformly understood by line management.

SNL Yellow Brick Road

Sandia National Laboratories

- A “Yellow Brick Road” is a fabled path to a promised land
  - Yellow bricks highlight the road
  - Road signage supports assessment of progress
- Achieving this fabled path of meeting the intended mission using
  - common MA framework implemented at the appropriate level of rigor
  - facilitates monitoring and achievement of a quality product

Bricks for Lean MA Yellow Brick Road

- Common framework that integrates SE, project management, and quality management
- Right sizing project implementation of this framework
- Applying the framework as early as possible
- Further right sizing – tailoring and waiving
- Using project archetypes to inherit MA artifacts
- Providing a repository that contains reusable processes, plans, templates, examples, …

Development process

1. Benchmark of similar external organizations
2. Note gaps for R&D types of projects
3. Develop rigor determination template (PMACE)
   a) 1.5 years
   b) Multi-disciplinary team
   c) Pilot in different program areas, different project types
4. Develop mission assurance plan template (PMAP)
   a) Based on industry standards, lessons learned, assessments
5. Develop MA procedures

Began the establishment of the SNL MA Framework in 1998

Sandia National Laboratories

"Mission Assurance is a broad term intended to encompass those elements necessary for meeting customer expectations with quality processes and scope-appropriate project/risk management."

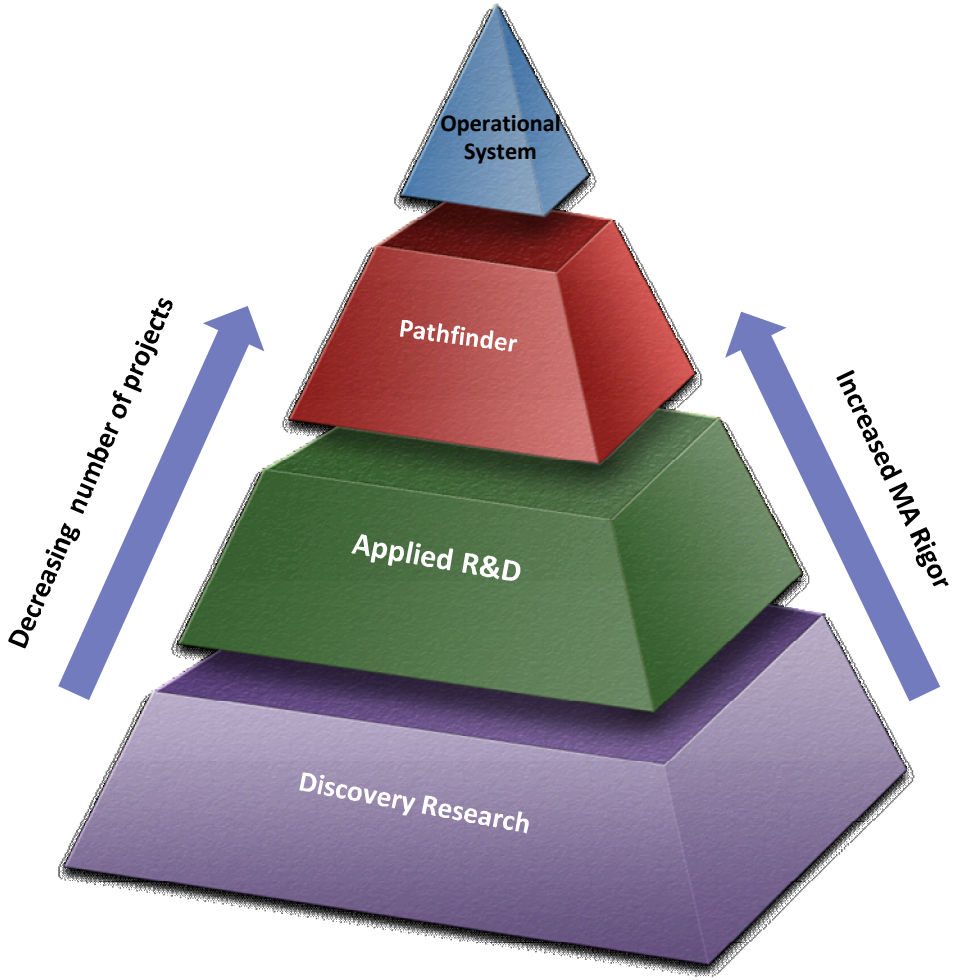
Vision:

Provide for the aggregation of SE,QM and EPM for the purpose of delivering quality products and services to our customers and provide management clear insight into the health of the project.

Accomplished by:

Creating Mission Assurance processes using existing programs as prototypes while developing a framework that can be replicated across the DS&A PMU.

National Security Programs Mission Assurance Framework



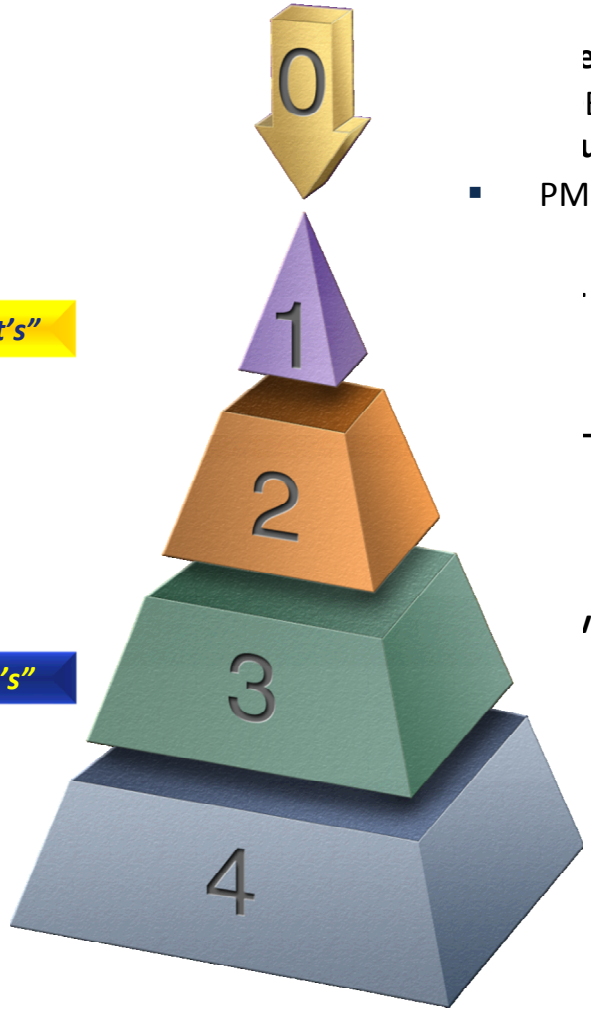
Working Closely with Key Stakeholders to Share/Leverage Lessons Learned

NSP Mission Assurance External & Internal Requirements

Sandia National Laboratories

Level 1 - 2 Defines the "What's"

Level 3 - 4 Defines the "How's"



ernal Requirements

E O 414.1D requires a graded approach

ustry Standards/Best Practices

- PMBOK/ANSI 748/ISO15288/INCOSE/AS9100C

. Corporate Policy System

– Program Management Unit

NSP PMU Mission Assurance System
NSP Mission Assurance Governance

vel 3 – Program Areas

- Mission Assurance Implementation Plan
- Customer Program/Project Requirements

Level 4 – Program/ Project Implementation

- Mission Assurance Project Documentation

NSP PMU Mission Assurance Meets DOE O 414.1D and the SNL Corporate Policy System

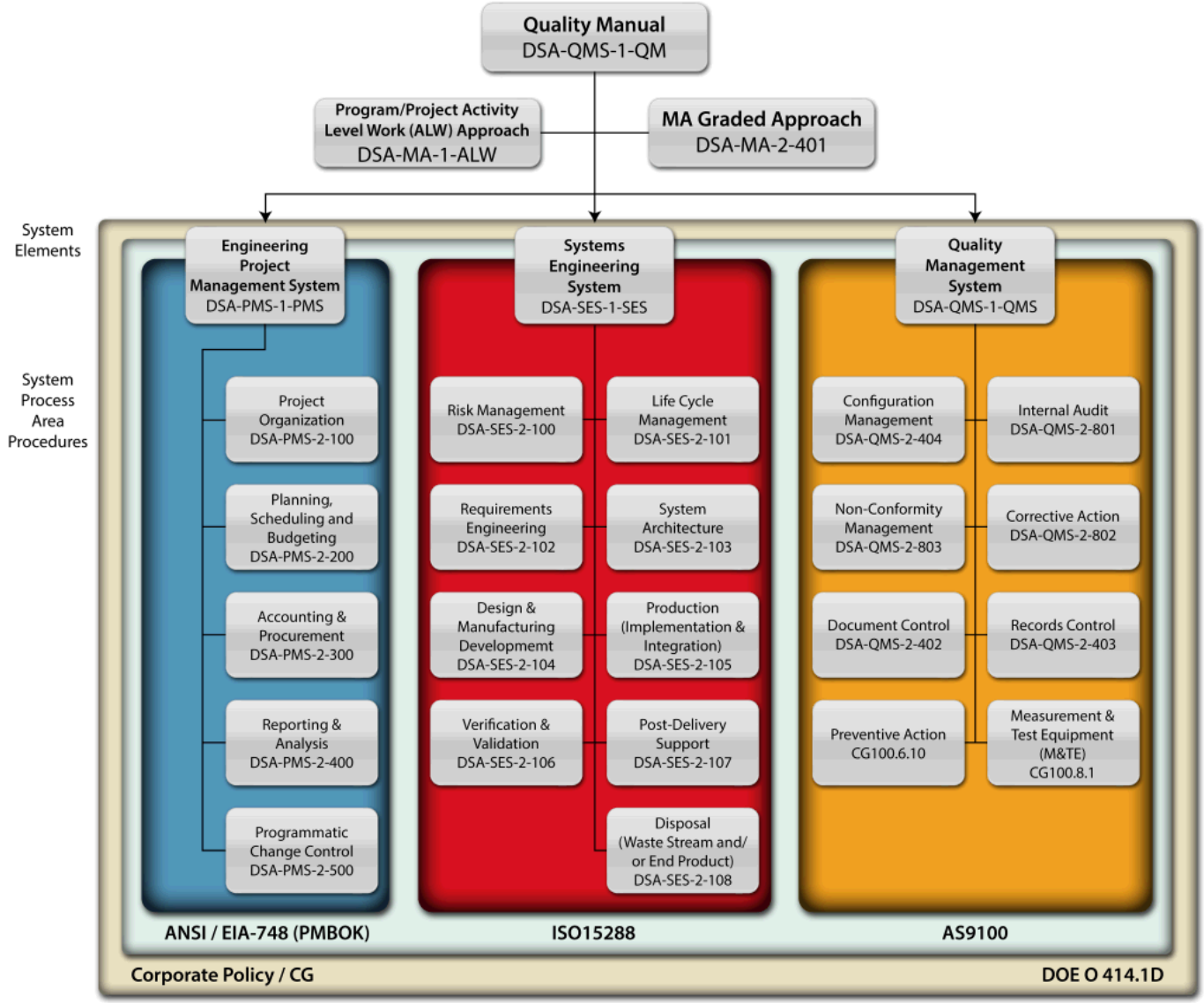
A Common MA Framework

Sandia National Laboratories

- A consistent MA approach, tools and expertise
- Implementation flexibility
- Based on
  - Industry-standard techniques
  - Lessons learned/causal analyses and assessments

Overview NSP PMU MA

System/Framework Based on AS9100



NSP PMU MA core graded approach documents

Sandia National Laboratories

Mission Assurance Governance (MAG)	▪ Overview of DSA PMU Mission Assurance ▪ Requirements document from DSA VP to all DSA PMU Members of the Workforce to implement the DSA Graded Approach Procedure
Graded Approach Procedure (GA)	▪ Requirements document implementing the GA process within DSA PMU
Mission Assurance Implementation Plan (MAIP)	▪ How each Program Area is implementing the MAG and GA
Project Mission Assurance Category Evaluation (PMACE)	▪ Risk-informed approach to determine category (i.e., PMAC A/B/C/D) of a project and then the requisite level of rigor for Mission Assurance
Project Mission Assurance Plan (PMAP)	▪ PMAP templates (PMAP-A/B/C/D) contain DSA MA rigor attributes for each of the System Process Areas within the System Elements (SE, QM, and PM).

Program/project team applying the concept of critical thinking to determine & document the program's/project's specific MA requirements

Right Sizing Implementation of the MA Framework

Sandia National Laboratories

- The graded approach
  - Level of rigor determination template – "project categorization"
    - 10 questions
    - 4 levels of rigor (from highest in all areas ←→ low level in core areas)
    - Risk informed
    - Project intrinsic characteristics
    - Useful at any point in the project's life cycle
  - Recommend multi-disciplinary team (PM, technical lead) fill out template
  - Project manager signoff
  - Project MA Plan template for each level of rigor
  - Level of rigor attributes
    - Timing
    - Scope
    - Formality

Apply the MA Framework as early as possible

Sandia National Laboratories

- PM, QM and SE activities are
  - Considered
  - Negotiated
  - Communicated
  - Planned
  - Budgeted
- Support informed decision making and communication of the project's MA requirements
  - Provides a means for projects to document their program/project requirements
  - Provides management with a means of tracking and evaluating progress

Further Right Sizing

Sandia National Laboratories

- Waive and tailor to fit business needs
- Core MA requirements cannot be waived
  - Follow MA framework graded approach
  - Project charter
  - Milestone list
  - WBS
  - Budget
  - Change order log
  - Requirements management approach
  - Risk management approach
  - Configuration management approach
  - Quality control

Further Leaning
Project Archetypes

Sandia National Laboratories

- Archetypes form basis for sharing MA artifacts
  - Project MA Plan, which includes generic processes and templates
- If a new project is “similar enough” to an archetype → inherit MA artifacts
  - Similarity is based on level of rigor determination template
- Projects may change archetypes during their life cycle

Monitoring and continuous improvement

Sandia National Laboratories

- Core MA requirements implementation status tracked for new projects
- MA Community of Practice
- Management review
- Measures and metrics
  - Goals & metrics defined at the project/program/program area levels for 2 phases; tracked and reported

Monitoring and sustainment

- SNL

1. Rollout to program areas
   a) VP letter
   b) Mission Assurance Implementation Plans
   c) Mission Assurance Community of Practice (MACoP)
2. MA Measures and Metrics Plan
   a) Phased approach

SNL: Roles, responsibilities, accountability and authority

Sandia National Laboratories

Vice President

Mission Assurance Governance (MAG) document

- MAG communicates expectations and minimum core requirements to Program Area Directors
- Management Review 3
- Documented roles & responsibilities

Program Area Directors

Mission Assurance Implementation Plan (MAIP)

- Responsible for implementing NSP Mission Assurance framework requirements to active projects
- Management Review 2
- Representatives Actively Participate on Mission Assurance Community of Practice (MACoP)

Cognizant Managers (CMGR) Technical Project Leads (TPL)

PMACE/PMAP/Implementation Plan

- Define and implement project-specific Mission Assurance requirements on all active projects
- Management Review 1
- Level 3 manager responsible and accountable
- Team Lead is responsible and works with their Integrated Project Team

Measures and metrics

- *Plan for Establishing Goals, Measures and Metrics for Implementation of the Mission Assurance Core Requirements*[1]
  - Goals & metrics defined at the project/program/program area levels for 2 phases
  - Use Goal/Question/Metric framework
  - Tracked and reported

[1]Primary authors include Bobbie Surbey, Mike Williamson and Ann Hodges

Project goals

Project Goals	Phase	
	Phase 1 (March 2013 – May 2013)	Phase 2 (June 2013 - Present)
Deliverable Goal	Each Deliverable Complete	Each Deliverable Visible/Repeatable
Project Goal	100% of Deliverables are Complete	100% of Deliverables are Visible/Repeatable

Visible/Repeatable (~CMMI L3): The deliverable is complete and the deliverable is accessible by authorized personnel (generally via a link). Objective evidence shows repeatable implementation.

Measures and metrics

Project level

Overall Project Metric

Project Metric	All Phases		
	All Deliverables State	When	Status
Project Overall based on status of all deliverables	*Any Red*	*Anytime*	*Red*
	Any Yellow and no Red	*Anytime*	*Yellow*
	All Green	*Anytime*	*Green*

Project Metric	Phase 1			Phase 2			Phase n		
	Deliverable State	When	Status	*Deliverable State*	When	Status	*Deliverable State*	When	Status
Metric for Each Group 1 Deliverable: • Project Charter • Milestone List • WBS, Budget • PMACE	*Complete*	*Anytime*	*Green*	*Visible/ Repeatable*	*Anytime*	*Green*	*Effective*	*Anytime*	*Green*
				Complete	*Anytime*	*Yellow*	*Visible/ Repeatable*	*Anytime*	*Yellow*
	Not Complete	*Anytime*	*Red*	*Not Complete*	Anytime	*Red*	*Not Visible/ Repeatable*	*Anytime*	*Red*
Metric for Each Group 2 Deliverable: • Change Order Log • Rqmt Mgmt Approach • Risk Mgmt Approach • Configuration Mgmt Approach • Quality • PMAP	*Complete*	*Anytime*	*Green*	*Visible/ Repeatable*	*Anytime*	*Green*	*Effective*	*Anytime*	*Green*
	Not Complete	*Before Project Active Date*	*Yellow*	*Not Visible/ Repeatable*	*Before Project Active Date*	*Yellow*	*Not Visible/ Repeatable*	*Before Project Active Date*[8]	*Yellow*
	Not Complete	*After Project Active Date*	*Red*	*Not Visible/ Repeatable*	*After Project Active Date*	*Red*	*Not Visible/ Repeatable*	*After Project Active Date*[8]	*Red*

Program goals

Program Goals	Phases		
	Phase 1 March 2013	Phase 2 June 2013	Phase n TBD
Deliverable Goal	Each Deliverable Complete	Each Deliverable Visible/Repeatable	Each Deliverable Effective (When it supports business need.)
Program Overall Goal	At least 90% of Projects in the Program are Green	At least 90% of Projects in the Program are Green	At least 90% of Projects in the Program are Green

Measures and metrics
Program level

Program Metrics	All Phases	
	Projects	Status
Program Metric by Project	Each Project overall status	*Same as Project Overall Metric(G/Y/R)*
Program Overall Metric (all Projects, all Deliverables)	*100% Green*	*Blue*
	90% to 100% Green	Green
	75% to 90% Green	Yellow
	<75% Green	Red

Date: mm/dd/yy	Metric for each Requirement Deliverable by each Project in the Program											Project Overall	Program Overall
Project	Group 1					Group 2							
	PC	ML	WBS	B	PMACE	COL	RqMA	RiMA	CMA	QC	PMAP		
1	G	G	G	G	G	G	G	G	G	G	G	G	7 Total Projects (5 rated Green, 1 Yellow & 1 Red) **5/7 G = 71%**
2	G	G	G	G	G	G	G	Y	G	G	G	Y	
3	G	G	G	R	G	G	G	Y	G	G	G	R	
4	G	G	G	G	G	G	G	G	G	G	G	G	
5	G	G	G	G	G	G	G	G	G	G	G	G	
6	G	G	G	G	G	G	G	G	G	G	G	G	
7	G	G	G	G	G	G	G	G	G	G	G	G	

Bricks Make "the *right* thing to do the *easier* thing"

Sandia National Laboratories

- Common framework that integrates SE, project management, and quality management
- Right sizing project implementation of this framework
- Applying the framework as early as possible
- Further right sizing – tailoring and waiving
- Using project archetypes to inherit MA artifacts
- Monitoring and continuous improvement
- Providing a repository that contains reusable processes, plans, templates, examples, …

Acknowledgements

The SNL author wishes to acknowledge other members of the SNP Mission Assurance team, both past and present, who have contributed to the development and implementation of the NSP MA framework

Mary Abt
Brenda Byrd
Phil Chamberlain
Rick Glaspy
Barbara LaGree
Kathy Lane
Marlo Maxson
Alexis Stenke
Bobbie Surbey
Tristan Thompson
Mike Williamson