Bricks for a Lean Systems Engineering Yellow Brick Road

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Yellow Brick Road

- A "Yellow Brick Road" is a fabled path to a promised land
  - Yellow bricks highlight the road
  - Road signage supports assessment of progress
- In the systems engineering (SE) world, achieving this fabled path of meeting the intended mission using
  - common SE framework implemented at the appropriate level of rigor
  - facilitates monitoring and achievement of a quality product

Bricks for Lean SE 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, …

Background

- Sandia National Laboratories (SNL) is a government-owned, contractor operated facility

- Defense Systems and Assessments (DS&A) Strategic Management Unit (SMU) 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

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
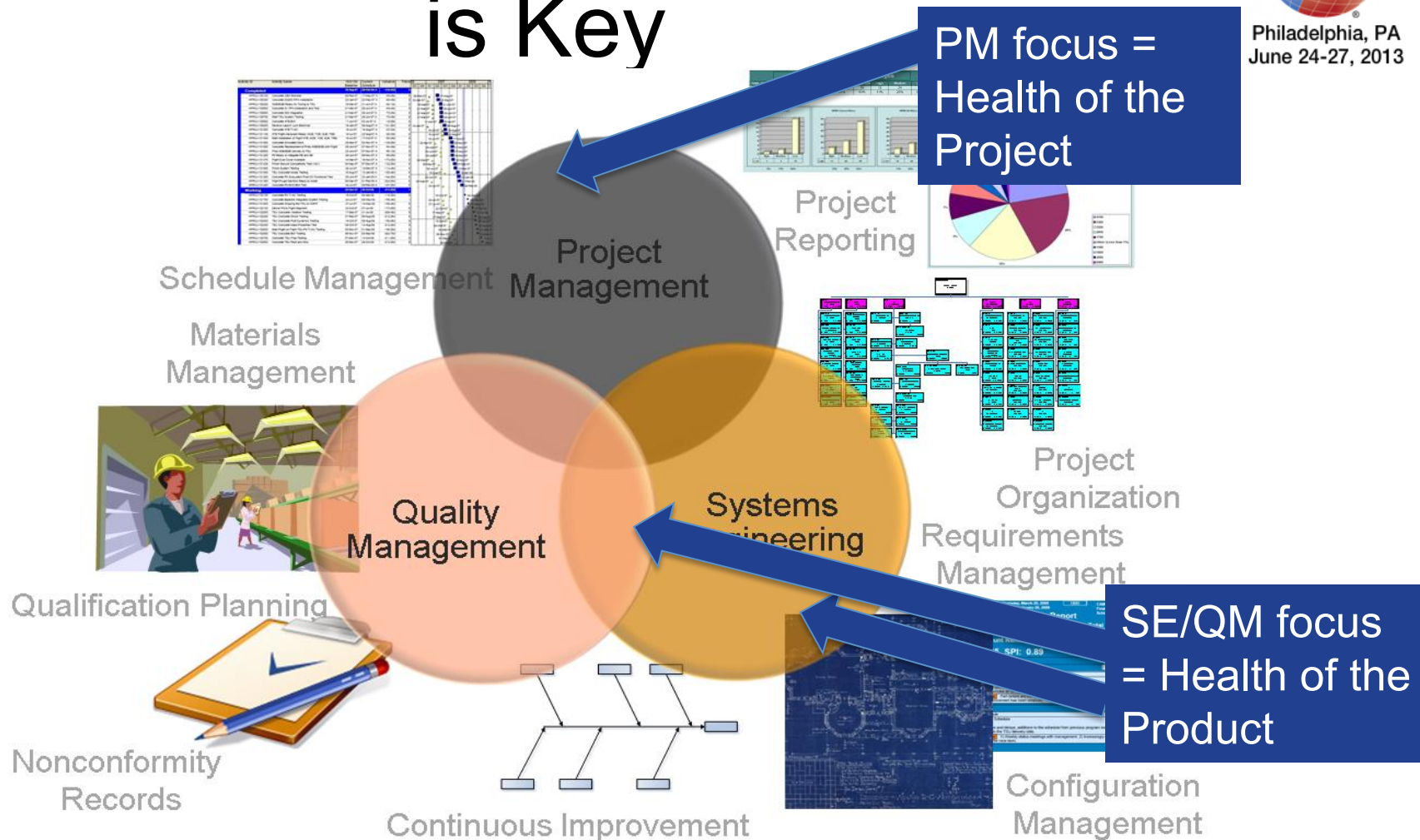
What is Mission Assurance? DS&A SMU's Definition

The DS&A SMU'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

Integration of PM, SE and QM is Key

PM focus = Health of the Project

SE/QM focus = Health of the Product

Schedule Management

Project Management

Materials Management

Project Reporting

Quality Management

Systems Engineering

Project Organization

Requirements Management

Qualification Planning

Nonconformity Records

Continuous Improvement

Configuration Management

Integration Leads to Increased Assurance of Mission Success

A Common MA Framework

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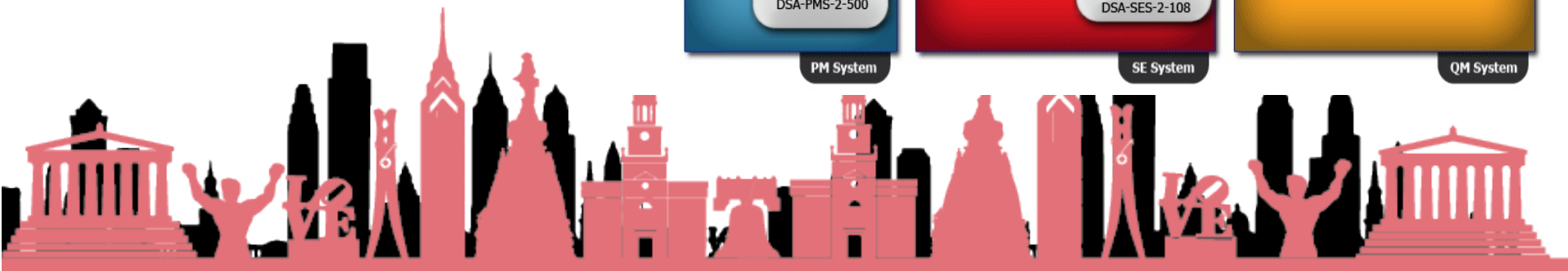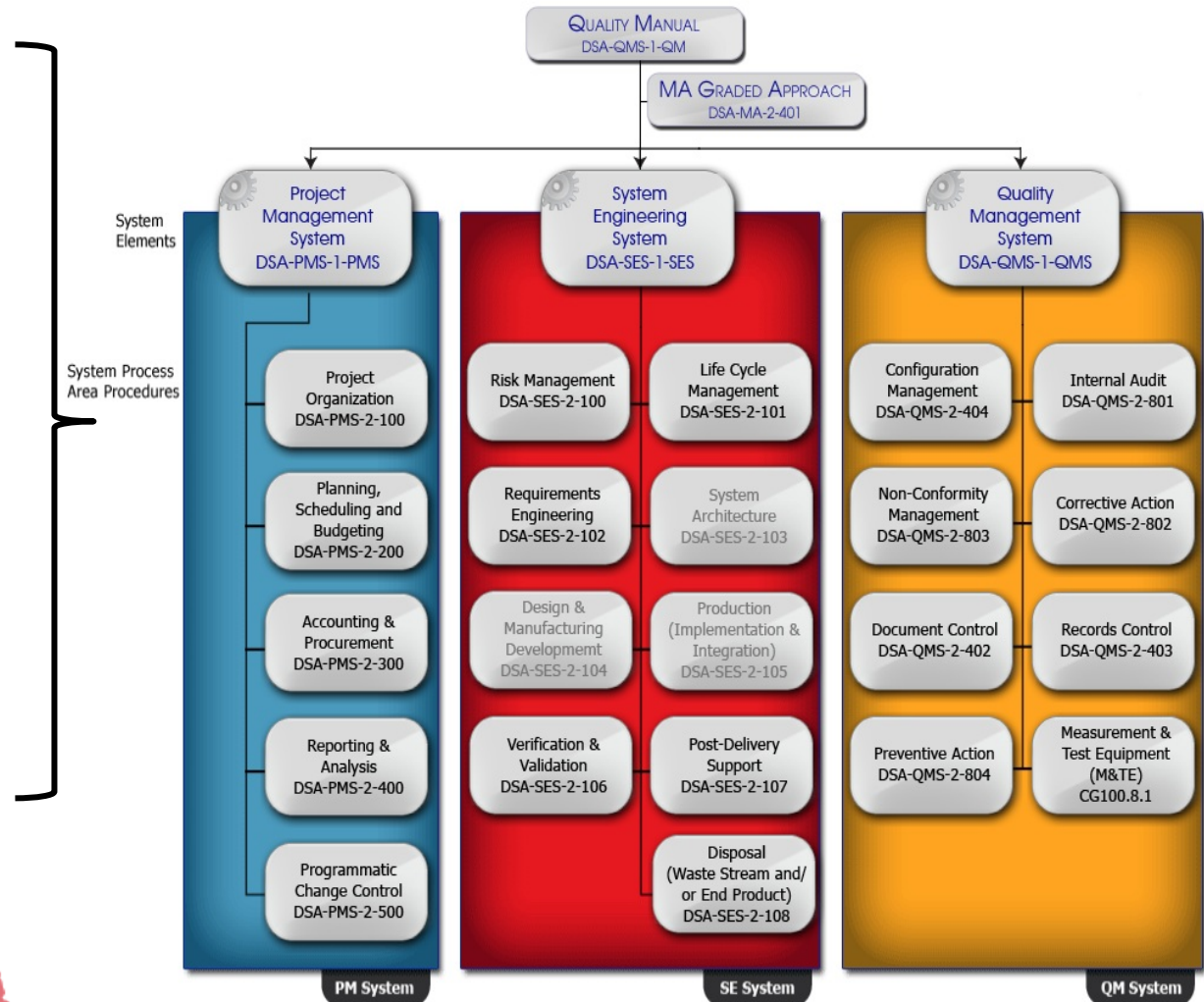 - Lessons learned/causal analyses and assessments

DS&A SMU MA Framework

Mission Assurance System based on applicable Industry Standards

- PM System based on ANSI 748 and PMBOK
- Quality System based on AS9100C
- Systems Engineering based on ISO 15288
  - DoD Defense Acquisition University (DAU) Life Cycle

AND

- SNL Corporate Governance/ Corporate Policies
- DOE O 414.1D

System Elements

Quality Manual
DSA-QMS-1-QM

MA Graded Approach
DSA-MA-2-401

Project Management System
DSA-PMS-1-PMS

System Engineering System
DSA-SES-1-SES

Quality Management System
DSA-QMS-1-QMS

System Process Area Procedures

Project Management System	System Engineering System	Quality Management System
Project Organization DSA-PMS-2-100	Risk Management DSA-SES-2-100 / Life Cycle Management DSA-SES-2-101	Configuration Management DSA-QMS-2-404 / Internal Audit DSA-QMS-2-801
Planning, Scheduling and Budgeting DSA-PMS-2-200	Requirements Engineering DSA-SES-2-102 / System Architecture DSA-SES-2-103	Non-Conformity Management DSA-QMS-2-803 / Corrective Action DSA-QMS-2-802
Accounting & Procurement DSA-PMS-2-300	Design & Manufacturing Developmemt DSA-SES-2-104 / Production (Implementation & Integration) DSA-SES-2-105	Document Control DSA-QMS-2-402 / Records Control DSA-QMS-2-403
Reporting & Analysis DSA-PMS-2-400	Verification & Validation DSA-SES-2-106 / Post-Delivery Support DSA-SES-2-107	Preventive Action DSA-QMS-2-804 / Measurement & Test Equipment (M&TE) CG100.8.1
Programmatic Change Control DSA-PMS-2-500	Disposal (Waste Stream and/ or End Product) DSA-SES-2-108	

PM System   SE System   QM System

- The graded approach
  - Level of rigor determination template – "project categorization"
    - 10 questions
    - 4 levels of rigor
    - 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

- 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

- 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
    - Non-conformance/issues management

Further Leaning
Project Archetypes

- 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

Project Archetypes

Project Archetypes Benefits

- Simplifies level of rigor determination and MA planning

- Facilitates tracking of core MA requirements completion

- Foundation for sharing processes and tools

Yellow Pages Repository

- Contents
  - Processes
  - Templates
  - Examples
  - Tool registry
  - Services
  - SMEs

- Navigable, searchable
  - Support different views via metadata and "roadmaps"
    - SE "V", process area, project, level of rigor

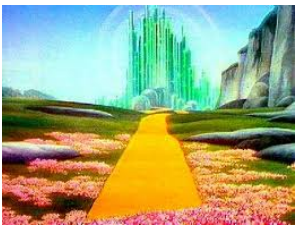# Monitoring and Continuous Improvement

- Core MA requirements implementation status tracked for new projects

- Efficiency of project archetypes use
  - time to implement MA requirements with and without archetype usage

- Set of archetypes tracked for relevancy

- MA Community of Practice

- Best practices reflected in Yellow Pages

- Management review

Bricks Make "the _right_ thing to do the _easier_ thing"

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Will We Get to Emerald City?

- Yes and No
  - Yes: The journey is made easier by leaning SE, PM and QM
  - No: Continuous improvement of the MA framework is a journey, not a destination

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Questions?

Survey

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