



29th Annual **INCOSE**
international symposium

Orlando, FL, USA
July 20 - 25, 2019

Ann Hodges, Distinguished Member of Technical Staff, CSEP, SAFe SPC4
Sandia National Laboratories

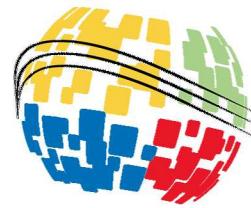


A Federally Funded Research and Development Center Perspective

Systems Engineering in Early Stage R&D Projects

SAND2019-xxxxx C

Sandia National Laboratories' (SNL) Implementation of Systems Engineering (SE)



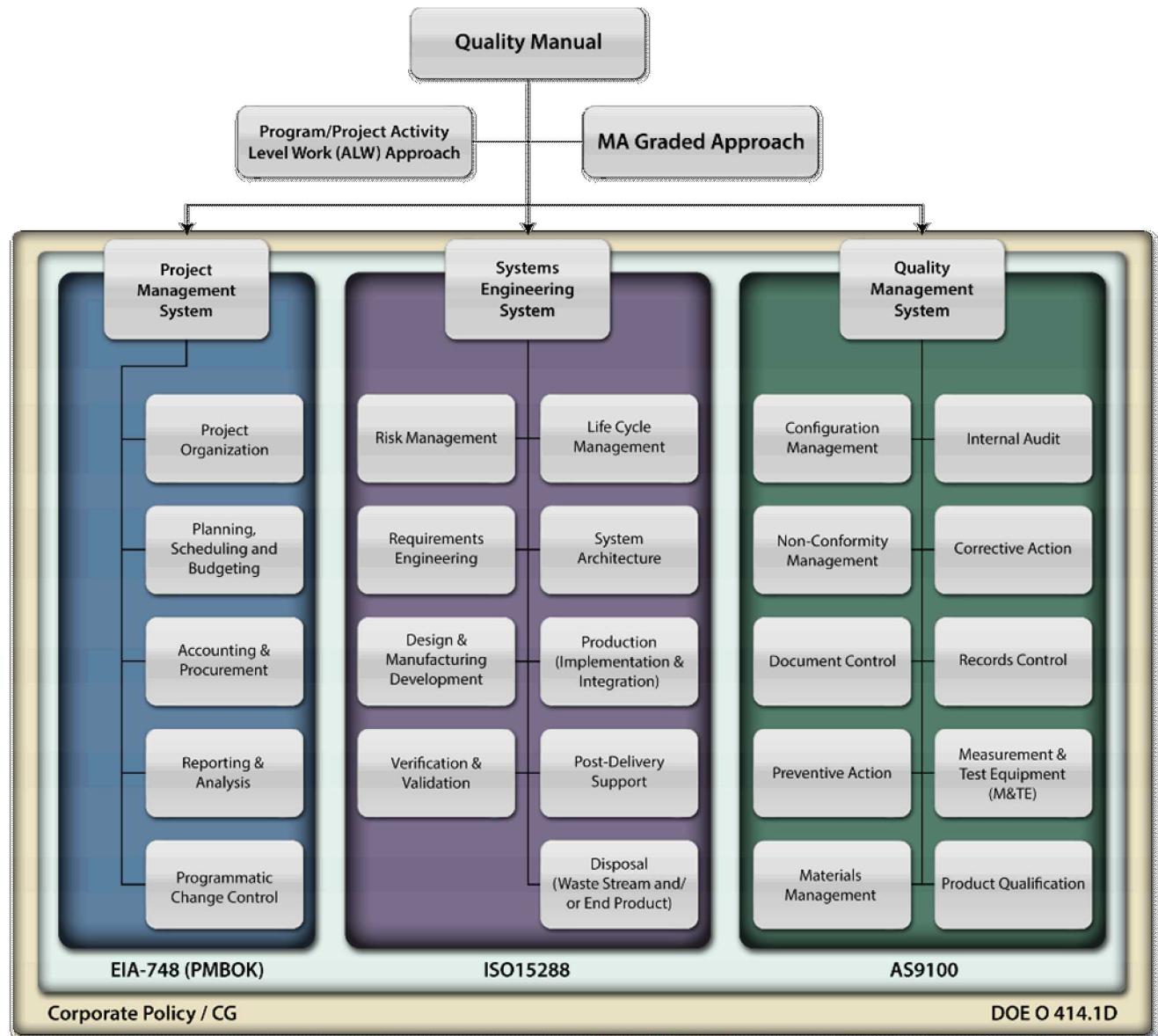
- SNL has implemented a risk-informed graded approach to mission assurance
 - the integrated right-sized application of SE, program/project management and quality management
- ... for the purposes of
 - delivering quality products and services to our customers to achieve mission success, and
 - provide management clear insight into the *health of the project* and the *health of the product*
- Initially developed for a large business unit, and is being propagated to the rest of SNL

Based on Industry Standards and Lessons Applied

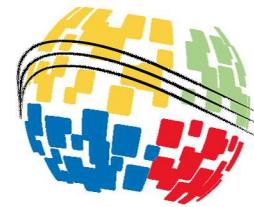


Mission Assurance Engineering System

- Science and Engineering Management Framework
- Science and Engineering Management Solutions
 - Recommended rigor determination (Project Evaluation)
 - Mission Assurance Plan (for determined rigor)
 - Measures and Metrics
 - Aras Engineering Management Solutions – CM/PLM
 - Risk Engineering Management



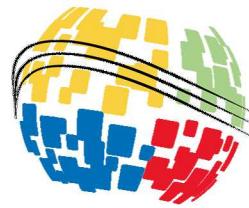
Further Right Sizing



- Waive and tailor to fit business needs
- Core mission assurance requirements cannot be waived
 - Follow mission assurance framework graded approach
 - Project charter
 - Milestone list
 - WBS
 - Budget
 - Financial reporting and analysis
 - Change control
 - Requirements management approach
 - Risk management approach
 - Configuration management approach (includes document and record control)
 - Non-conformance/Issues management

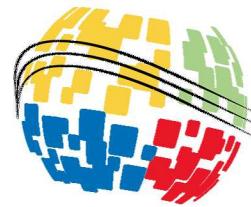
Determining core set of practices that every project follows was a challenge for a portfolio spanning basic research ↔ operational systems

What are the challenges in applying SE to an early stage R&D?



- SE practices may be unfamiliar to researchers
 - Need to reframe
- Determine set of right-sized practices that support future maturation and scalability
 - Right level of rigor
 - Nurture creativity and exploration
 - Preserve research quality, defensible research
- SEs more familiar with high rigor

When should SE be applied to early stage R&D? Are there triggers that could identify when SE should be applied?



- As early as possible
- Should be done for all projects



This Photo by Unknown Author is licensed under [CC BY-SA-NC](#)

Is there a compelling value proposition for “selling” the idea of applying SE to early stage R&D projects?

- Right-sized rigor
 - Timing
 - Scope
 - Formality
- Develop “pull” vs. “push”
 - What are researchers’ ideas for practices that preserve research quality?
 - Reframe practices to R&D terminology
 - Coach PI, technical team leads in practices
- Templates and examples
 - Don’t start with a “blank sheet of paper”

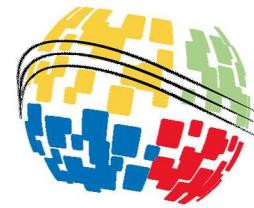


[This Photo](#) by Unknown Author is licensed under
CC BY-SA-NC



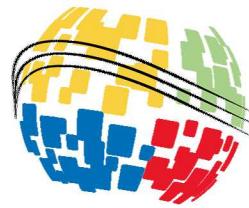
What SE concepts have the biggest “bang for the buck” in these types of projects? What SE practices, when applied early in an R&D project, support future growth if there is a desire to “productionize” the R&D’s focus area?

- Core mission assurance requirements
 - Project charter
 - Milestone list
 - WBS
 - Budget
 - Financial reporting and analysis
 - Change control
 - Requirements management approach
 - Risk management approach
 - Configuration management approach
 - Non-conformance/issues management



Are these the right set of requirements?

Need your help – *participate in the ESRD Working Group!*



How to tailor SE for early stage projects?

- Risk-informed graded approach
- Right-sized rigor
 - Timing
 - Scope
 - Formality
- Templates, examples

Summary



SE for Early Stage R&D: Questions and responses





29th Annual **INCOSE**
international symposium

Orlando, FL, USA
July 20 - 25, 2019

www.incose.org/symp2019