

Appendix A to “Analysis of Systems Engineering Competencies and Proficiency Levels by Role for an MBSE-Enabled Project,” submitted for publication to the *IEEE Open Journal of Systems Engineering*, October 2025

Sarah G. Shaw
PhD Candidate
Department of Systems Engineering

Appendix A

The first Systems Engineering (SE) project defined for this research is System Requirements Definition and Traceability. The tasks for this project were initially drafted using the International Council on Systems Engineering (INCOSE) Systems Engineering Handbook v5 [1] with review and updates from the Digital Engineering (DE) and SE expert panel. The following table shows the finalized list of tasks for this project.

Table A.1. Tasks for System Requirements Definition and Traceability

<i>Project 1: System Requirements Definition and Traceability</i>	
<i>Task 1: Program Management/Admin</i>	
1.1.1	Identify stakeholders and manage engagement, expectations, and needs
1.1.2	Define program/system scope, including system boundaries and work breakdown structure
1.1.3	Define and manage program/acquisition strategy and implement business rules
1.1.4	Define and drive vision and way-ahead for the team
1.1.5	Manage project progress and outcome, including understanding the programmatic/technical/cost/schedule implications of programmatic/technical/cost/schedule decisions
1.1.6	Define and manage cost/budget
1.1.7	Define and manage schedule, ensuring focus on major milestones
1.1.8	Define and manage personnel, roles, teams, and organizational structure, to include internal teaming agreements/needs, meeting cadence, reporting/deliverables requirements, and training
1.1.9	Define and manage required tools and equipment, including Information Technology (IT) infrastructure, prototypes, simulators, testbeds, engineering models, etc.
1.1.10	Define and manage risk and program compliance
1.1.11	Manage access to facilities/spaces, including IT infrastructure
1.1.12	Define process for and manage Change Management, Configuration Control (requirements, project documentation, etc), and Quality Control
1.1.13	Define, manage, and execute required reviews
1.1.14	Manage project documentation/technical document library and compile and deliver relevant contract deliverables and documents
1.1.15	Manage Security and maintain Security Classification Guide
1.1.16	Manage IT/cyber support and ensure coordination with Security
<i>Task 2: Define System Requirements</i>	
1.2.1	Define functional boundary in terms of the behavior and properties the system will provide, including system performance attributes, throughput, and responsiveness needs
1.2.2	Identify/obtain stakeholder key functional/performance requirements and iteratively review
1.2.3	Define functions and associated performance, system Concept of Operations (CONOPs), and Use Cases
1.2.4	Define constraints on the program/system, operating environment, interactions with external systems, externally-driven requirements, and required new interfaces; create required documentation
1.2.5	Identify and capture system requirements and attributes and create requirements baseline
1.2.6	Identify requirements that relate to risk, criticality, critical quality characteristics, and compliance with standards and regulations
1.2.7	Begin to define verification success criteria for each requirement, verification strategy, verification method, verification plan, and responsible organization, and continue to iterate
<i>Task 3: Analyze System Requirements</i>	
1.3.1	Analyze requirements to ensure they are correct, complete, consistent, traceable, understandable, appropriate to level, verifiable/measurable, and feasible, adjudicating and refining as necessary
1.3.2	Define critical performance measures
1.3.3	Review analyzed requirements with stakeholders and resolve any issues

1.3.4	Analyze requirements for criticality (e.g., impact of non-satisfaction) and sensitivity (e.g., impact of partial satisfaction)
1.3.5	Prioritize requirements, if needed
1.3.6	Develop performance models and analyses to model and/or test to validate and/or verify requirements
1.3.7	Determine system compliance criteria and margin to requirements
<i>Task 4: Manage System Requirements</i>	
1.4.1	Establish and sustain requirements traceability
1.4.2	Establish, document, and manage system requirements change process, including a means to identify impacts of a proposed requirements change
1.4.3	Establish and manage baselines for information items, work products, or other artifacts
1.4.4	Manage progress of requirements development, change, and satisfaction

REFERENCES

- [1] D. D. Walden *et al.*, Eds., *INCOSE Systems Engineering Handbook, 5th Edition*, 5th ed. John Wiley & Sons, Inc., 2023. Accessed: July 17, 2023. [Online]. Available: <https://www.wiley.com/en-us/INCOSE+Systems+Engineering+Handbook%2C+5th+Edition-p-9781119814290>