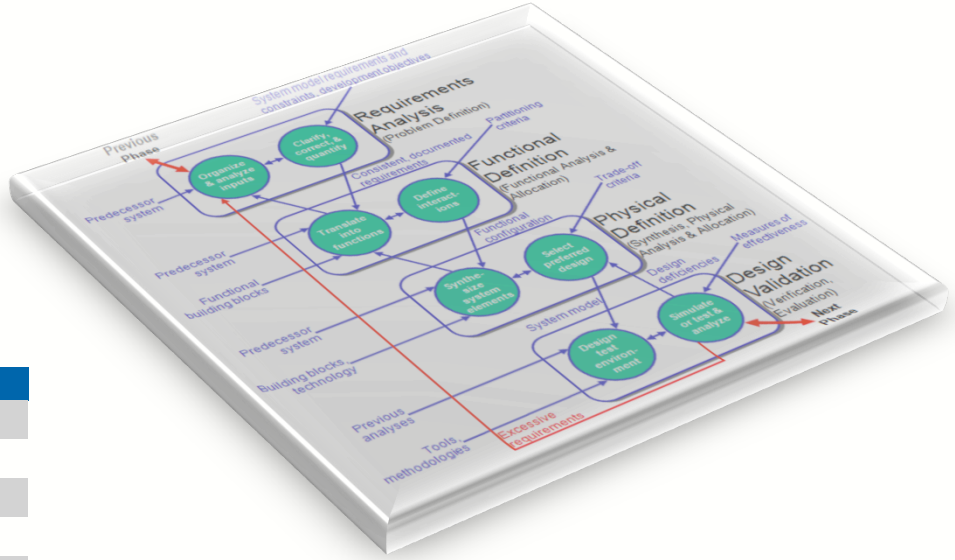
Systems Engineering Project Overview

Presentation (Project-1)



Lesson Title	
Presentation ID	Project-1
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JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

Lesson Objectives & Course Map

- At the end of this lesson, the student should be able to:
  - Construct a Systems Engineering Project (SM4) timeline
  - Describe the role of the SM4 Project Instructor & Mentor
  - Summarize the expectations for each primary SM4 deliverable

Topics

- Project Timeline
- Project Instructor vs. Mentor
- Project Deliverables
- Other Recommendations

SM4 Project Timeline (Notional)

Week	Activity	Comments
Enrolled in System Design & Integration	Access Systems Engineering Project (SM4) site and review materials	All students registered for SM2 will be granted access to the Blackboard SE Project site
Enrolled in System Test & Evaluation	Identify Project Instructor and Mentor	The earlier, the better! ☺ Either contact a mentor listed in the Systems Engineering Project Guidelines or contact the Project Instructor for designation of a mentor. Request access to your Project Instructor's group and your Mentor's group on Blackboard.
-10	Explore subjects for project/identify mentor	Start exploring project ideas with your mentor.
-5	Submit concept	The concept paper should clearly define the scope of your project. This deliverable is approved by the Project Instructor.
-2	Submit proposal	This is a formal proposal. This deliverable is approved by the Project Instructor.
0	Proposal approved	The specific schedule for the remaining deliverables will be captured in your project proposal.
1	Coordinate plans with mentor	Identify meeting periodicity, review methods…
+3	Submit Requirements Analysis Report/CONOPS	This deliverable is approved by your assigned mentor.
+4	Submit Functional Analysis Report	This deliverable is approved by your assigned mentor.
+6	Submit Trade Study	This deliverable is approved by your assigned mentor.
+8	Submit Conceptual Design Report	This deliverable is approved by your assigned mentor.
+10	Submit Test Plan	This deliverable is approved by your assigned mentor.
+11	Submit A-Specification Report	This deliverable is approved by your assigned mentor.
+12	Submit Draft Final Report/Risk Management Report	This deliverable is approved by your assigned mentor.
+14	Deliver Final Report and Oral Presentation	You are required to present your completed project to the SM4 Review Board. Your final grade will be determined by the Board.

Mentors

- SM4 Mentors are available to review your Project Concept and Project Proposal deliverables prior to submission to your Project Instructor for approval.
  - If you don't know how to contact an SM4 mentor, contact Jacqueline Rowe at 240-228-6002 or at Jacqueline.Rowe@jhuapl.edu.
- Once your Project Proposal is approved, your mentor is available to:
  - Answer questions
  - Review deliverables/provide feedback
  - Approve deliverables
  - Assess your readiness for the final oral presentation
- It is important to note that SM4 is an individual project. Don't expect your Mentor to manage your schedule. You are responsible to complete the project as documented in your proposal.

Project Proposal

- Read the overview in the latest SM4 guidelines
- The proposal includes:
  - System Introduction
  - Need for the System
  - System Architecture/Description of System
  - Project Background

    WBS
    Milestones and Schedules
    Risk Management/Initial Risk Assessment
- Systems Engineering Justification

Requirements Analysis

- Recommendations:
  - Start traceability at the beginning! Establish a mechanism to maintain traceability from needs analysis through system conceptual design
    Maintain traceability to your sources: interviews, web searches, literature searches…
  - Design your products to be easily updated. As you employ the SE process, you will find the need to update earlier products
    Don't forget to number your requirements (a hierarchical numbering system is best)
  - Document the source of every requirement
    Should include interview results as an Appendix
  - Include a concept of operations
  - Include key performance parameters
  - Make sure your requirements are verifiable (verification cross reference matrix)

Functional Analysis Report

- A simple function tree is simply not adequate to establish a functional architecture.
- Develop the products required by *your* project to adequately describe the functional architecture
  - Function Trees
  - Functional Context Diagram
  - Functional Block Diagrams
  - Functional Flow Diagrams
  - States and Modes diagrams
  - Interface Diagrams
  - …

Conceptual Design

- When translating your functional architecture into the physical domain, don't forget traceability!
- Document your physical interfaces and maintain traceability with your functional interactions
- Develop the products required by *your* project to adequately describe the functional architecture
  - Physical Context Diagram
  - Physical Block Diagrams
  - Allocation Diagrams
  - Interface Control Documents
  - …

Trade-Off Analysis

- Recommendations:
  - Spend some time selecting the “right” trade study. Some are more important than others, and you will be asked to justify your choice.
  - Address how your trade study will address / mitigate risk on your project.
  - Check your numbers (including significant digits).
  - When performing sensitivity analysis, justify your approach.

Risk Management Report

- Capture risks at the beginning of the product and during execution
  - Technical risks (related to the system)
  - Project risks (related to the SM4 course)
- Use the standard 5x5 risk grid
- Update the report before every deliverable submission
- Capture the final state of the risks at the end of the course
- Include risk waterfalls
  - Show the risk levels over time on a graph
- In some instances, the Risk Management Report will be incorporated directly into the Final Report. Follow your Mentor's guidance.

Test Plan

- Develop a plan for which to evaluate your system's performance
- Facilitate consideration of the test portion of the systems engineering method
- Test plan should include:
  - The pertinent requirements that will be included in the test
  - The test environment
  - The equipment that would be needed to monitor and analyze the test
  - The test subjects/expertise to conduct and analyze the test
  - The desired results to determine if the test was successful
  - The metrics intended to be collected

System Specification

- It should incorporate “lessons learned” from your requirements analysis, functional analysis, physical allocation, and trade studies
- It should *not* be the same as the initial requirements analysis report
- All requirements should be verifiable (a verification matrix should be developed)
- All requirements should have associated MOPs (threshold and objective performance parameters)
- Include a metric that captures the number (and percentage) of quantified requirements

Final Report

- Recommendations:
  - Capture lessons learned throughout the project (don't try to remember them all at the end ☺).
  - Compare your estimated (planned) hours against your actual hours. Provide an explanation for any significant deviations.
  - Evaluate the project as a whole and identify follow-on activities as appropriate
  - Evaluate the SM4 course as a whole and provide recommendations for improvement
  - Include all project products (final versions) as appendices (including the oral presentation)
  - In-Class Students:

    Produce one/two final binders with all materials included (# of binders will be identified by your mentor)

    Produce one/two CDs with all materials included
  - Online Students:

    Upload all final artifacts to your Project Instructor's Blackboard site 24 hours prior to your presentation

Other Recommendations

- Configuration Control
  - Maintain configuration control of your products. As you receive feedback from your advisor/mentor, don't lose track of the changes!
- Quality Time
  - Dedicate quality time each week to work on SM4 products.
- Reference Notebook
  - Keeping all of your notes and references in one place can be very helpful as you make progress on your project or if you are called away on unexpected travel. Although a reference notebook is not a requirement, it's a good idea!

To CORE or note to CORE…

- The use of CORE is completely optional
- PROS
  - Maintains traceability
  - Generates diagrams
  - Maintains configuration control between database elements
- CONS
  - Takes ~20–30 hours to become proficient in the tool
  - CORE generated reports will require augmentation by the student
- To learn more about CORE, check out the YouTube videos created by Christopher (Chuck) Olson: https://www.youtube.com/results?search_query=JHUOlson

Questions?

Oral Presentation

- Recommendations:
  - Don’t forget to introduce yourself! Include a slide about yourself early in the presentation.
  - Include samples of each of your SE deliverables. Be prepared to discuss them in detail (a reference notebook would be very helpful).
  - Be prepared to delve into your project binder. Know where to find your various products.
  - Address your schedule assessment (planned vs. actual).
  - Leave enough time to discuss your lessons learned and recommendations.
  - Leave adequate time for questions.

References

- Flanigan, D. & Utara, C. (2015, August 15). *Systems Engineering Project (645.800) Guidelines and Requirements.*