LOCKHEED MARTIN
ENGINEERING

Systems Engineering Workflow Use Cases SysML Roadmap Activity INCOSE IW Working Sessions

John Watson, Rick Steiner, Dick Welling

1/27/2015

Background

- This activity is part of the SysML Roadmap activity within the OMG SE DSIG
- Intent
  - Identify the SE Capabilities and Infrastructure needs to develop systems through the entire lifecycle
- Near Term Goal
  - Identify where SysML may be used in the future to better support the SE needs
- Longer Term Goal
  - Help tool vendors support and automate SE Capability Needs
  - Framework for common practices

LOCKHEED MARTIN ENGINEERING

Basic Approach for SysML Roadmap

- Capture work in a SysML model
- Define the System Context Workflow Use Cases
- Capture the SE Workflow Use Cases
  - Use case goal, textual abstract and actors
  - Mature SE Workflows into Activities
  - Manage, refine and mature use cases
- Identify where SysML is/could be used
- Derive SysML Requirements from those tasks
- Periodically generated a review document from the model

Use Case Source Material

- INCOSE-TP-2003-002-03.2.2, *NCOSE Systems Engineering Handbook* v. 3.2.2, October 2011
- Pyster, A. and D.H. Olwell (eds). 2013. *The Guide to the Systems Engineering Body of Knowledge (SEBoK)*, v. 1.2. Hoboken, NJ: The Trustees of the Stevens Institute of Technology. Accessed DATE. www.sebokwiki.org/
- International Standard – ISO/IEC 15288 and IEEE 15288 – 2008, Second Edition 2008-02-01, Systems and software engineering - System life cycle processes

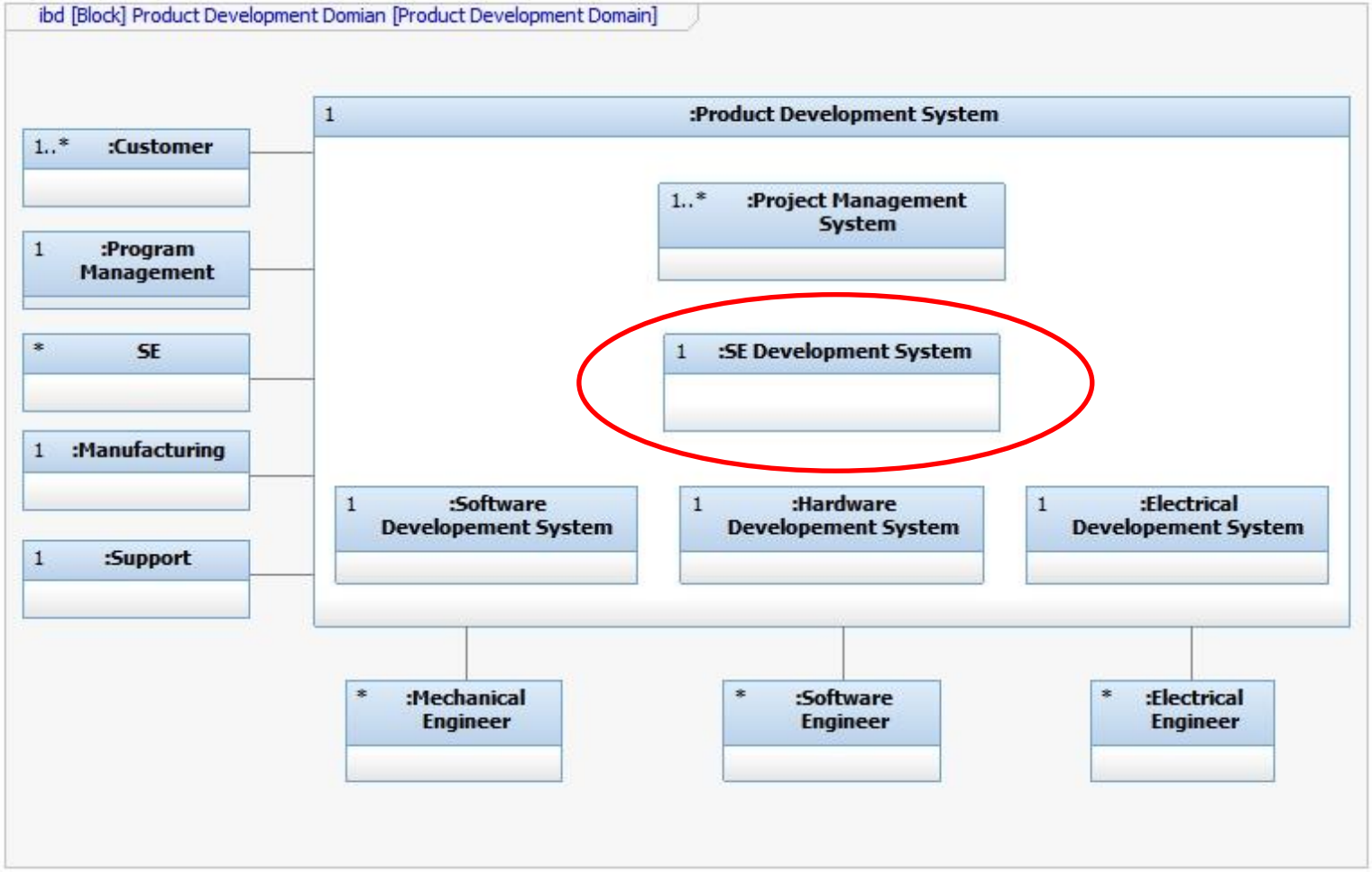
Team Members

- Model Capture and Management Team
  - Eldad Palachi, IBM
  - Rick Steiner, Skygazer Consulting
  - John Watson (Lead) - Lockheed Martin
  - Dick Welling - Boeing
- SME Contributors
  - Robert Karban (JPL)
  - Chris Delp (JPL)

Workflow Use Cases organized by Life Cycle Phases

- **Total 31 Use Cases Under Construction**
- **Organization of Use Cases by Stages**
  - **Exploratory/Concept Stage**
  - **System Development Stage**
    - **Management Use Cases**
    - **SE Domain Use Cases**
    - **Validation and Verification Use Cases**
  - **Production Stage**
  - **Product and Service Life Management**
    - **Utilization Stage**
    - **Support Stage**
    - **Retirement Stage**

Use Case Context



LOCKHEED MARTIN ENGINEERING

Selected Use Cases at OMG Tech Meeting Dec 2014

Use Case Name	Use Case Goal
Analyze Stakeholders Needs	The goal of this workflow use case is to identify all stakeholders and better understand and capture their required needs expectations, goals, and objectives across the entire product life cycle.
Derive System Requirements	The goal of this workflow use case is to derive a set of system level requirements for the system-of-interest based on the all stakeholder's needs requirements.
Derive Product Architecture	The goal of this workflow use case is to evaluate the System Requirements and from them derive the most appropriate architecture to satisfy the customer needs.
Evaluate System Safety	The goal of this workflow use case is to evaluate the system for safety related hazards and derive a plan to mitigate these risks.
Collaborate with Implementation Domain Team (software, mechanical, electrical)	Goal of this workflow use case is provide an automated capability to effectively share information between Systems Engineering and the component implementation engineering domains, such as the software, electrical, and mechanical domains.

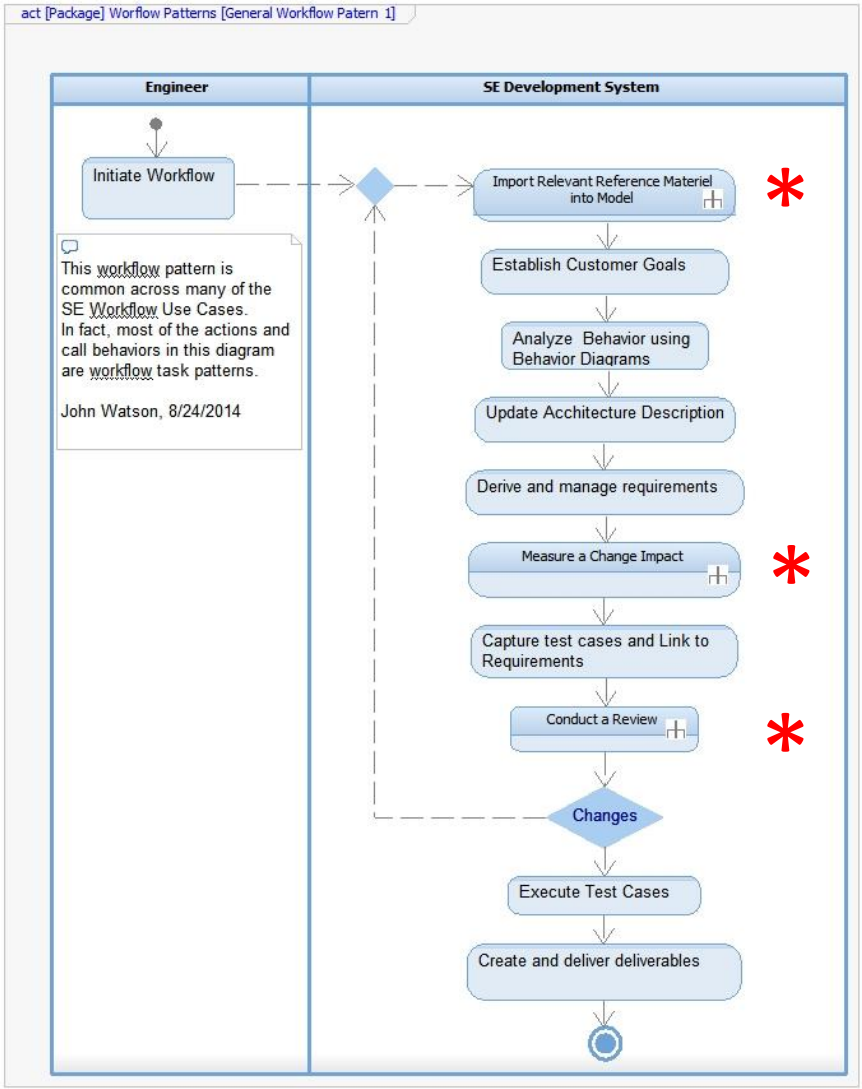
Workflow and Task Patterns

- Significance of Patterns
  - They become a reference for creating other workflows
  - They help identify repeatable, common steps
  - They becomes a focus for language and tool development

- Workflow Pattern 1
  - This pattern is common across many SE Workflow Use cases
  - Most actions are Workflow Task Patterns

- Task Patterns → *

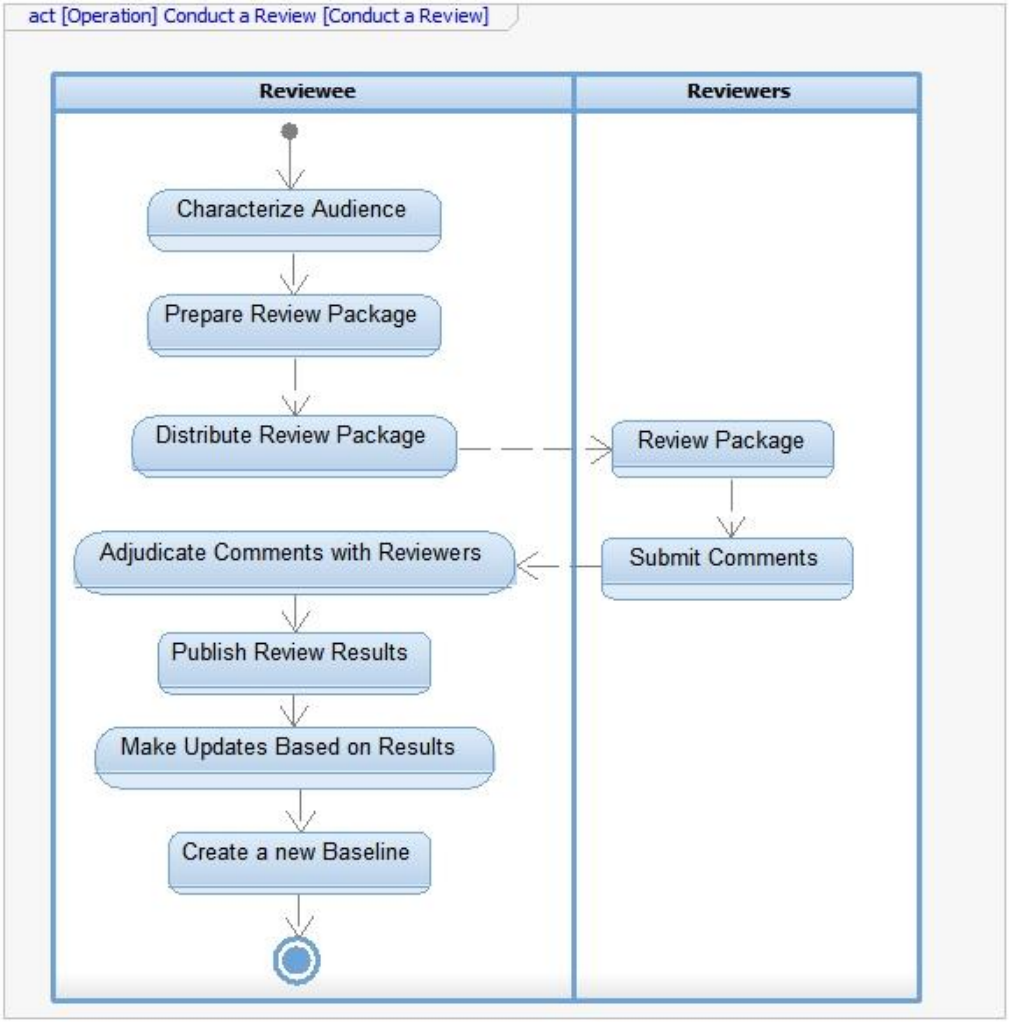
Workflow Pattern 1



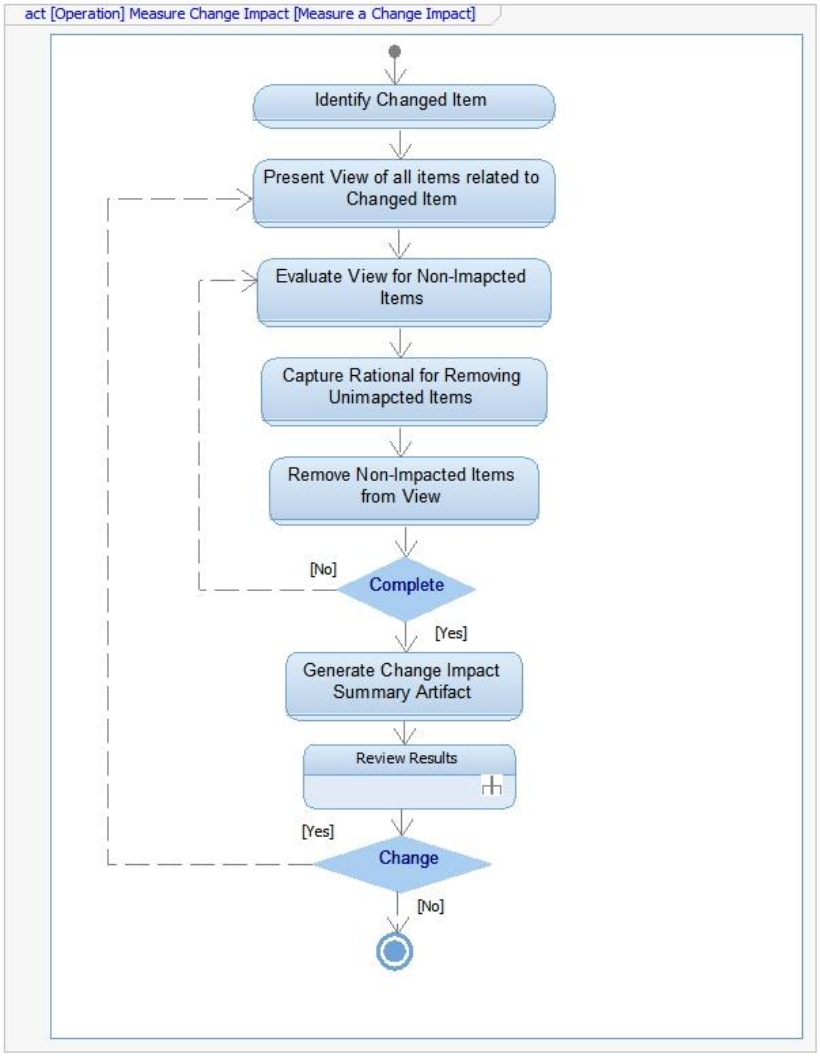
LOCKHEED MARTIN ENGINEERING

Example Task Patterns

Review Pattern



Change Impact Pattern



BACKUP SLIDES

Example Use Case to Evaluate SysML Usage
Perform System Security Engineering

- **Goal** – The goal of this use case is to incorporate in the system of interest the necessary security design features to meet the needs of the customer.
- **Primary Actor** – SE Security Specialist
- **Secondary Actors** –
- **Preconditions** –
  1. A list of known potential threats are available
  2. A list of applicable policy documentation is available

Activity - Perform System Security Engineering

This use case begins early in the development cycle and continues to iterate through the remaining development cycles as the product matures.

1. Obtain and/or define the customer's security protection goals for the following security domains including:
    1. Information security governance and risk management
    2. Access control
    3. Cryptography
    4. Physical (environmental) security
    5. Security architecture and design
    6. Business continuity and disaster recovery planning
    7. Telecommunications and network security
    8. Application development security
    9. Operations security
    10. Legal, regulations, investigations, and compliance
2. Capture the system vulnerabilities by analyzing the known or perceived threats and their behavior.

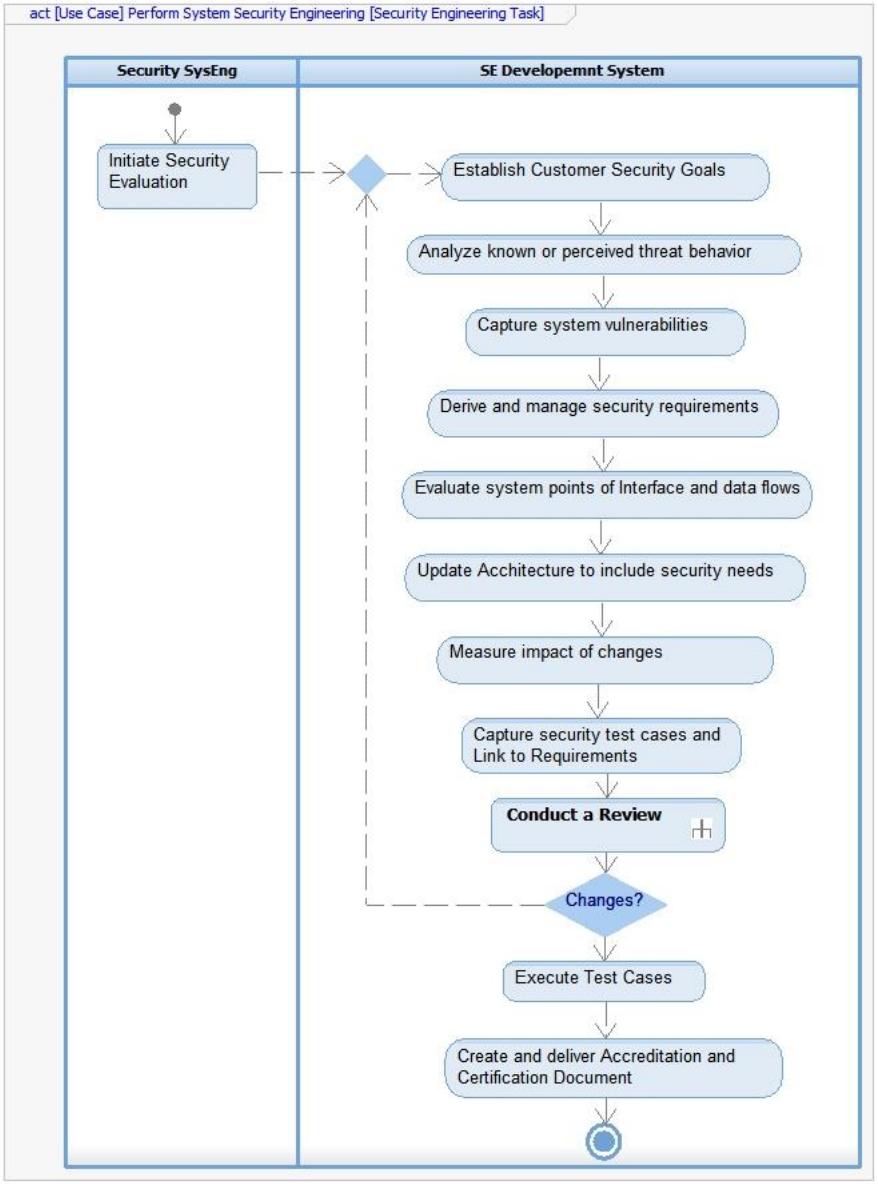
Activity - Perform System Security Engineering

3. Derive a set of security requirements that address the vulnerabilities and other applicable security policy documents.
4. Evaluate points of Interface;
    1. Identify all external interface points
    2. Identify internal interface points of major subsystems such as server farms, sensors, security management, business network, etc.
    3. Identifying the points of interface may have been completed earlier in a use case such as “Derive Product Architecture”.
    4. Determine and capture the level of security required for the information exchanged at the points of interface.
5. Capture the security architecture design that satisfy these requirements and minimize or contain the vulnerabilities.
6. Measure the change impact to other domains and mitigate issues
7. Conduct appropriate reviews within engineering and with the customer
8. Capture test cases that validate the security requirements have been reached.
9. If the proposed design does not meet the System goals, refine the design.
10. Prepare the necessary documentation for system accreditation and certification.

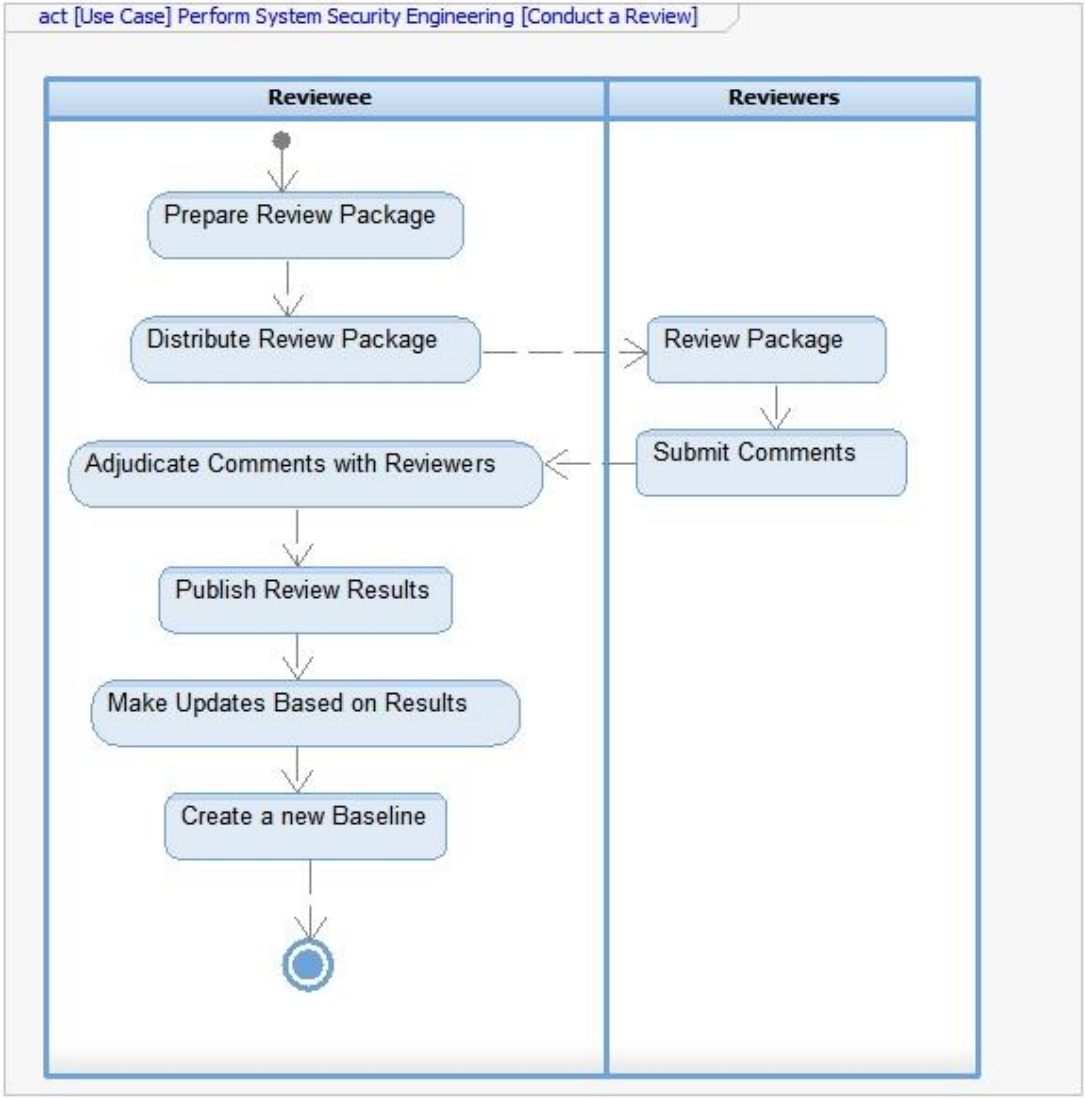
Post Conditions – Accreditation Certificate is submitted

LOCKHEED MARTIN ENGINEERING

Perform System Security Engineering UC

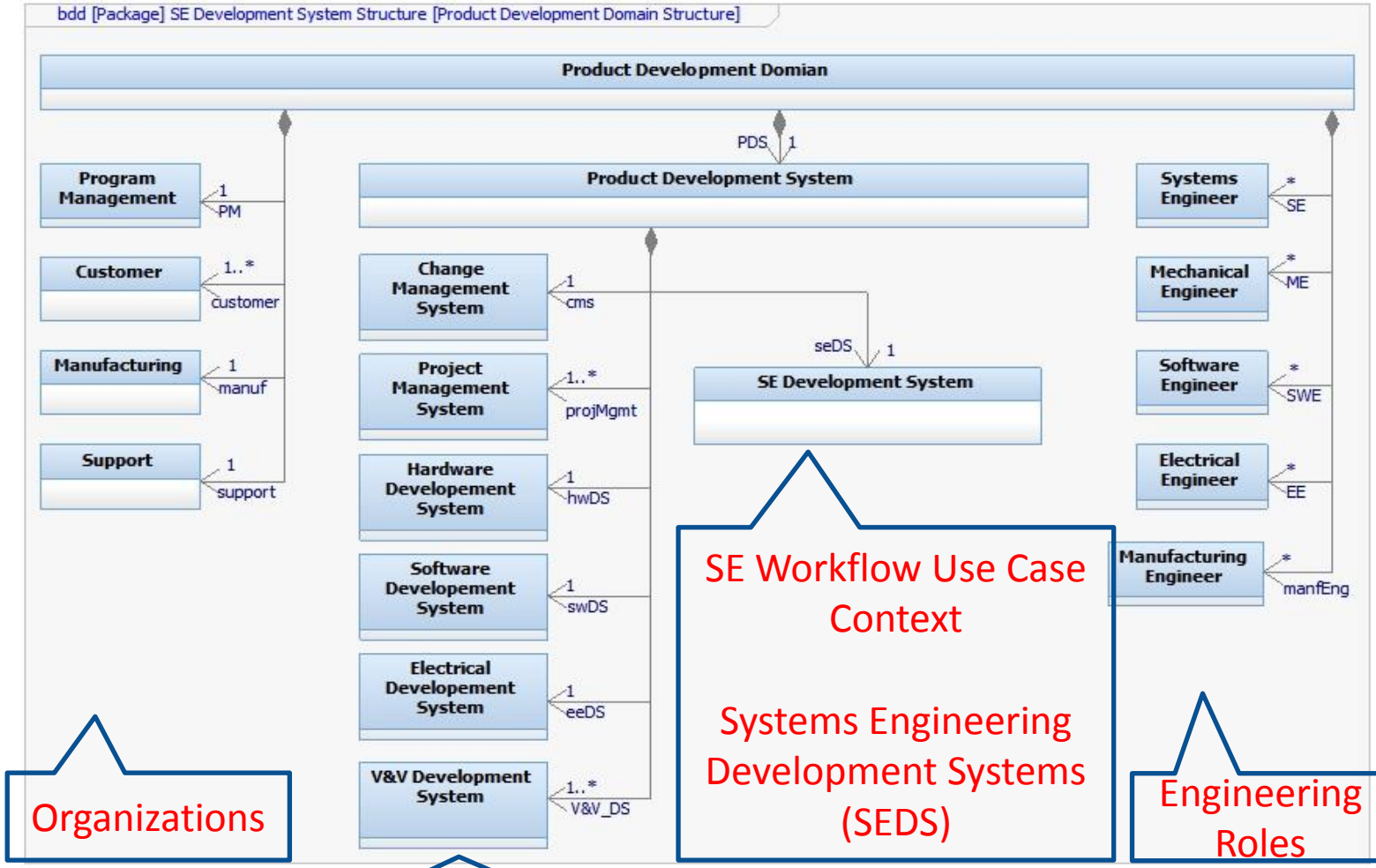


Artifact Review Pattern

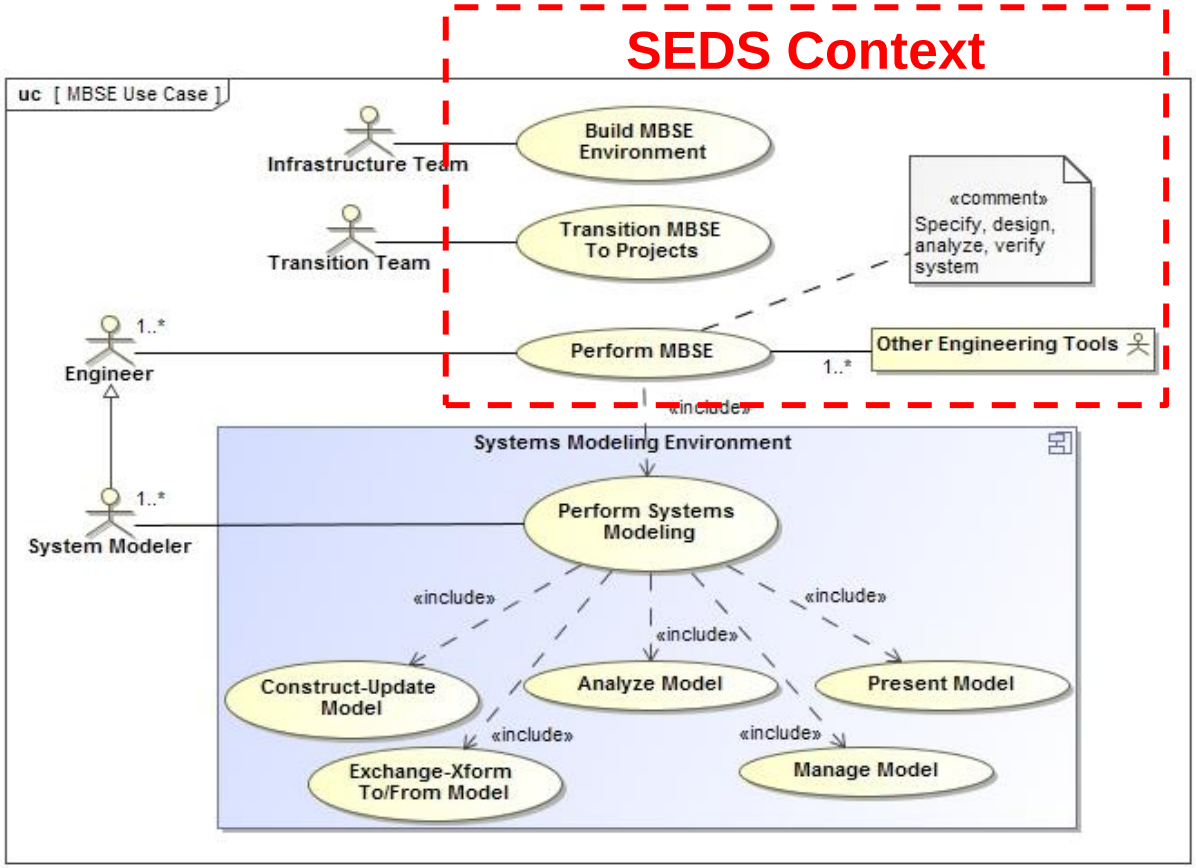


LOCKHEED MARTIN ENGINEERING

Define SE Development Environment Domain

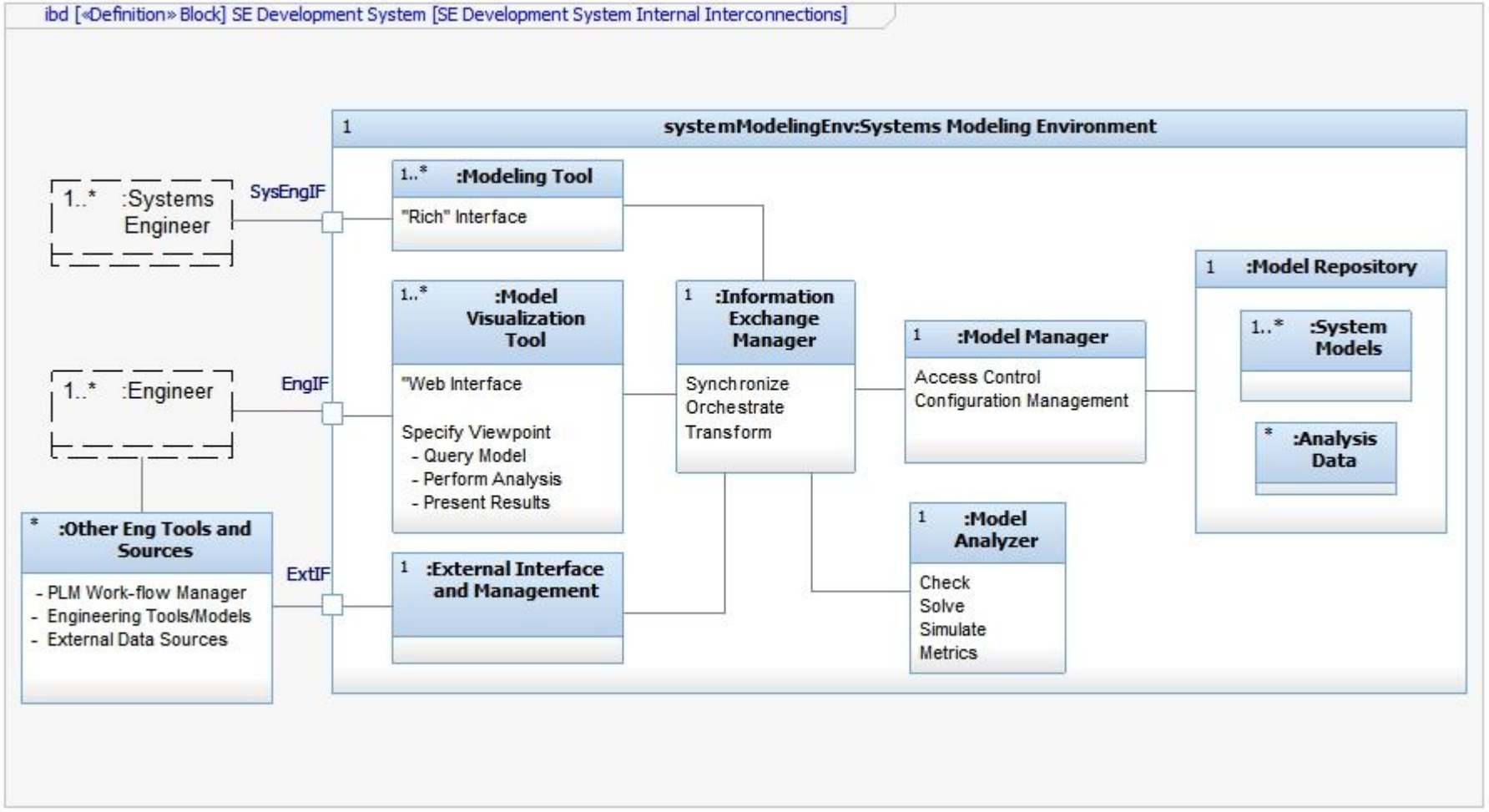


System Modeling Environment
Basic Functionality in Support of MBSE

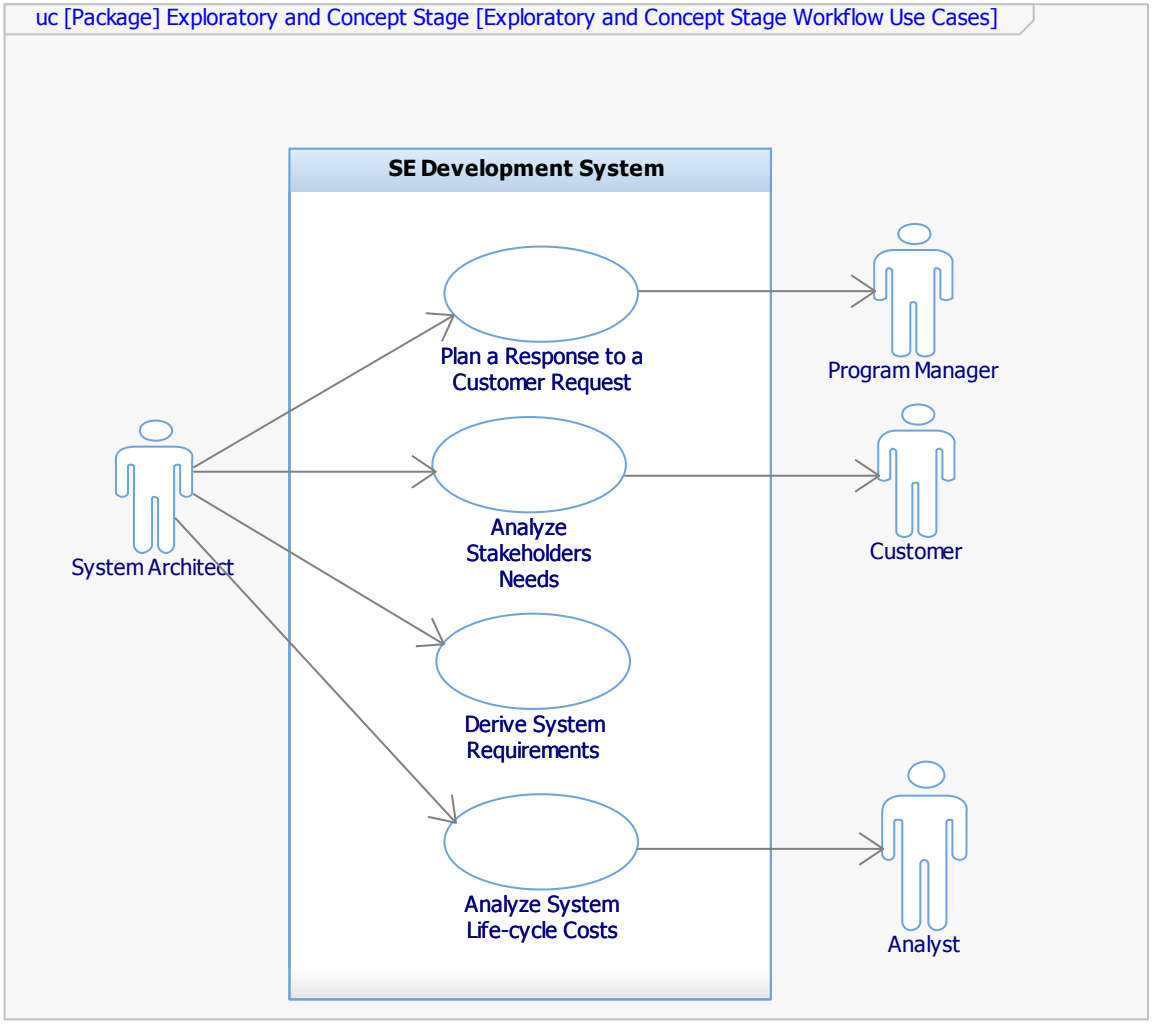


Slide from
"System Modeling Assessment Roadmap Intro and Results-Boston-palachi-friedenthal-140617-e.ppt"

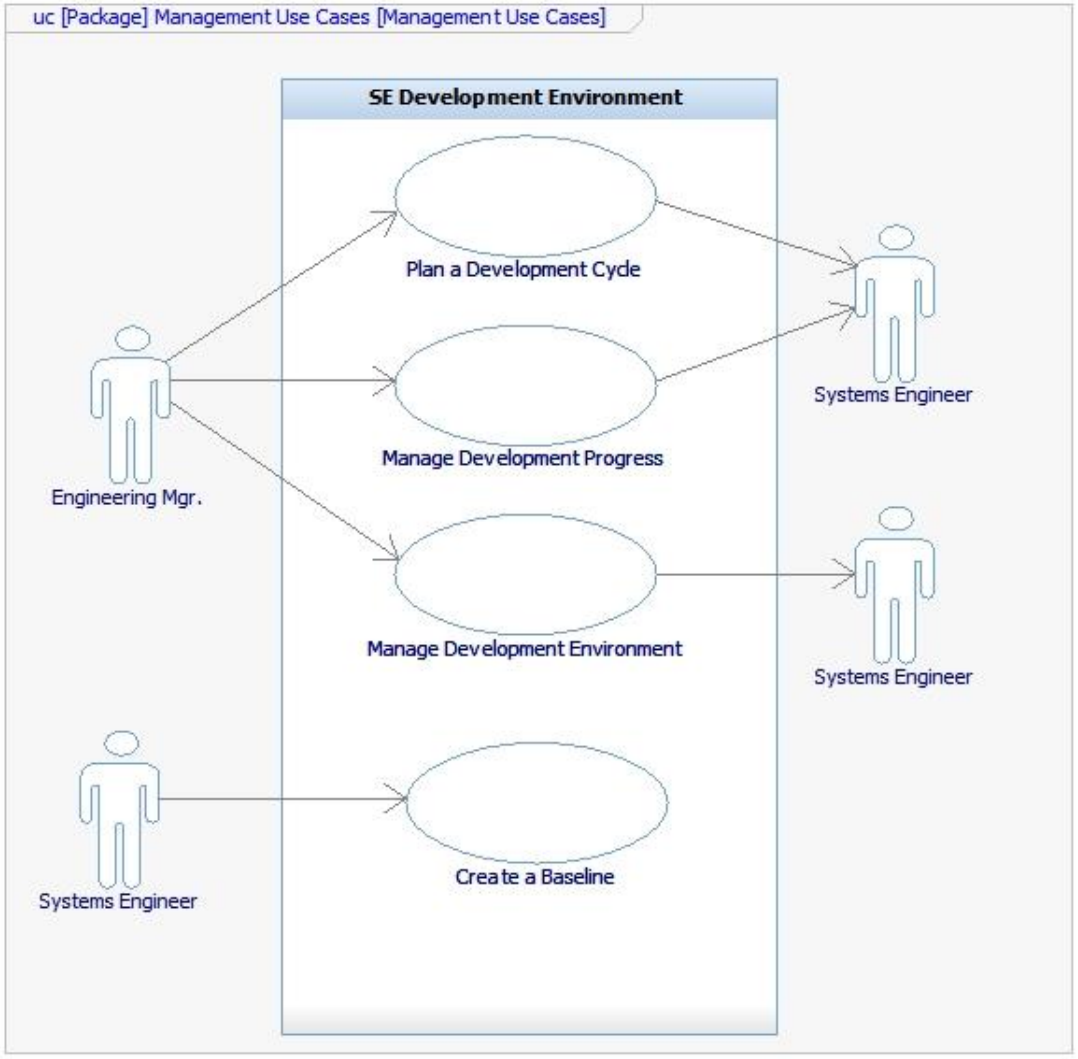
Ibd[Block]SE Development System[SEDS Internal Connections]



Exploratory/Concept Stage Use Cases

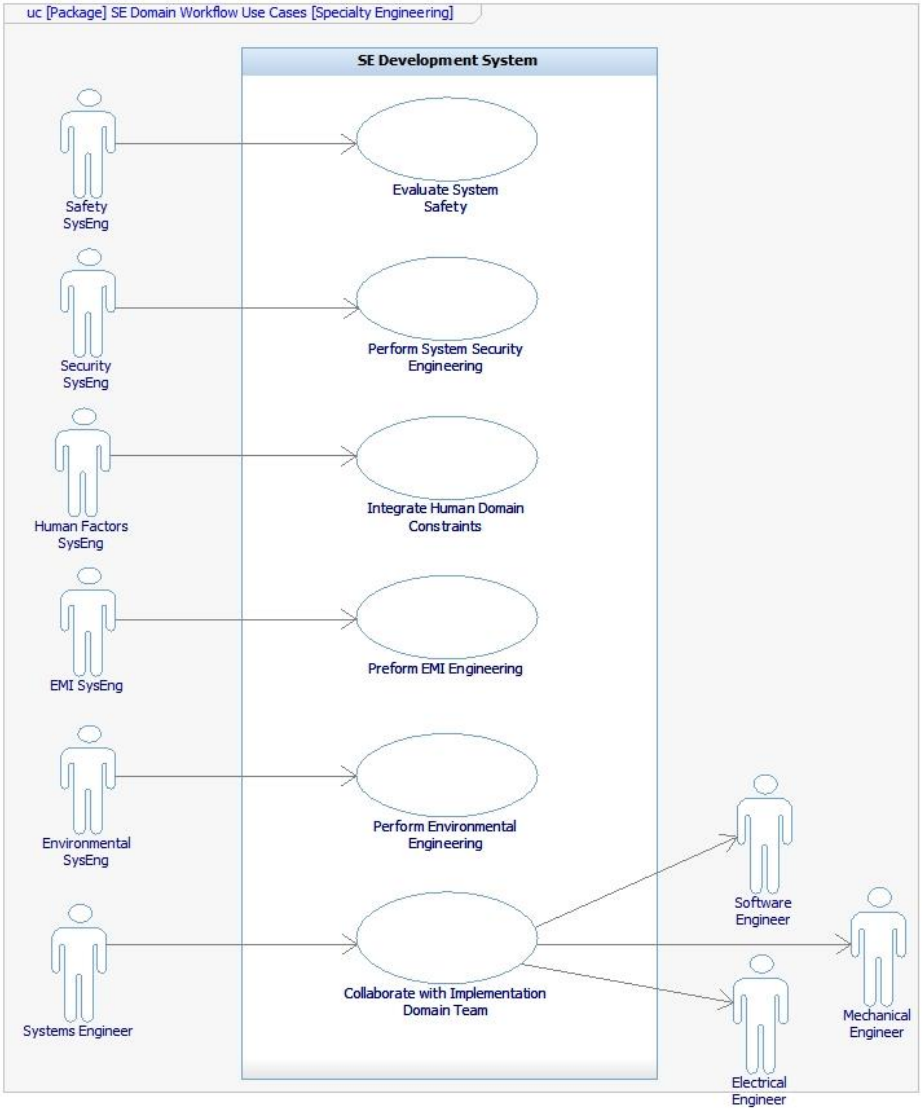


System Development Stage – Management Use Cases



LOCKHEED MARTIN ENGINEERING

System Development Stage – System Development
Specialty Engineering Use Cases



LOCKHEED MARTIN ENGINEERING

Roadmap SE Workflow Use Case Approach

1. Establish SE Use Case modeling team
   - Small team responsible for managing and capturing the model
2. Initial Modeling Effort
   - Capture Context
     - Systems Engineering Development System (SEDS)
   - Capture set of SE Workflow Use Cases
     - References include:
       - ISO/IEC 15288-2008
       - INCOSE Systems Engineering Handbook
       - System Engineering Book of Knowledge (SEBok)
     - Span across Life cycle
     - Initial effort identifies “What an SE does”

LOCKHEED MARTIN ENGINEERING

Roadmap SE Workflow Use Case Approach

3. Prioritize Use Cases
4. Refine and complete each of the use cases
   - solicit help from experts across the industry
5. Use Cases can be added, deleted or replaced
6. Periodically report progress to the SysML Roadmap Team and to the SysML RTF Team
7. Goals
   - Short Term - Help define the SysML Roadmap
   - Longer Term
     - Define a reference architecture for a fully integrated, cost effective, automated, and highly productive SEDS
     - Framework for common practices

How to Contribute

- **Total 31 Use Cases Under Construction**
- **At the last OMG meeting we selected 5 to address first**
- **Go to the IW MBSE wiki and follow the link to the SE UC Wiki for background and instruction**
- **On Tuesday there will be 2 sessions at 9 AM and 1 PM**
- **On the SE UC Wiki, the 5 use cases are listed**
- **Either tell or email me, Rick or Dick which ones you feel you could contribute and then show up**

Background

- Part of the SysML Roadmap activity within the OMG SE DSIG
- Intent
  - Identify the SE Capabilities and Infrastructure needed to develop systems through the lifecycle
- Near Term Goal
  - Identify where SysML may be used in the future to better support the SE needs
- Longer Term Goal
  - Help tool vendors support and automate SE Capability Needs
  - Framework for common practices

Use Case Source Material

- INCOSE-TP-2003-002-03.2.2, *NCOSE Systems Engineering Handbook* v. 3.2.2, October 2011
- Pyster, A. and D.H. Olwell (eds). 2013. *The Guide to the Systems Engineering Body of Knowledge (SEBoK)*, v. 1.2. Hoboken, NJ: The Trustees of the Stevens Institute of Technology. Accessed DATE. www.sebokwiki.org/
- International Standard – ISO/IEC 15288 and IEEE 15288 – 2008, Second Edition 2008-02-01, Systems and software engineering - System life cycle processes

Selected Use Cases at OMG Tech Meeting Dec 2014

Use Case Name	Use Case Goal
Analyze Stakeholders Needs	The goal of this workflow use case is to identify all stakeholders and better understand and capture their required needs expectations, goals, and objectives across the entire product life cycle.
Derive System Requirements	The goal of this workflow use case is to derive a set of system level requirements for the system-of-interest based on the all stakeholder's needs requirements.
Derive Product Architecture	The goal of this workflow use case is to evaluate the System Requirements and from them derive the most appropriate architecture to satisfy the customer needs.
Evaluate System Safety	The goal of this workflow use case is to evaluate the system for safety related hazards and derive a plan to mitigate these risks.
Collaborate with Implementation Domain Team (software, mechanical, electrical)	Goal of this workflow use case is provide an automated capability to effectively share information between Systems Engineering and the component implementation engineering domains, such as the software, electrical, and mechanical domains.