

# NASA Quality Assurance in an MBSE world

Monday January 27, 2020  
13:30 pm – 15:30 pm session

*presenter*



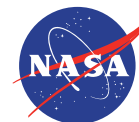
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**Jet Propulsion Laboratory**  
California Institute of Technology

# Agenda

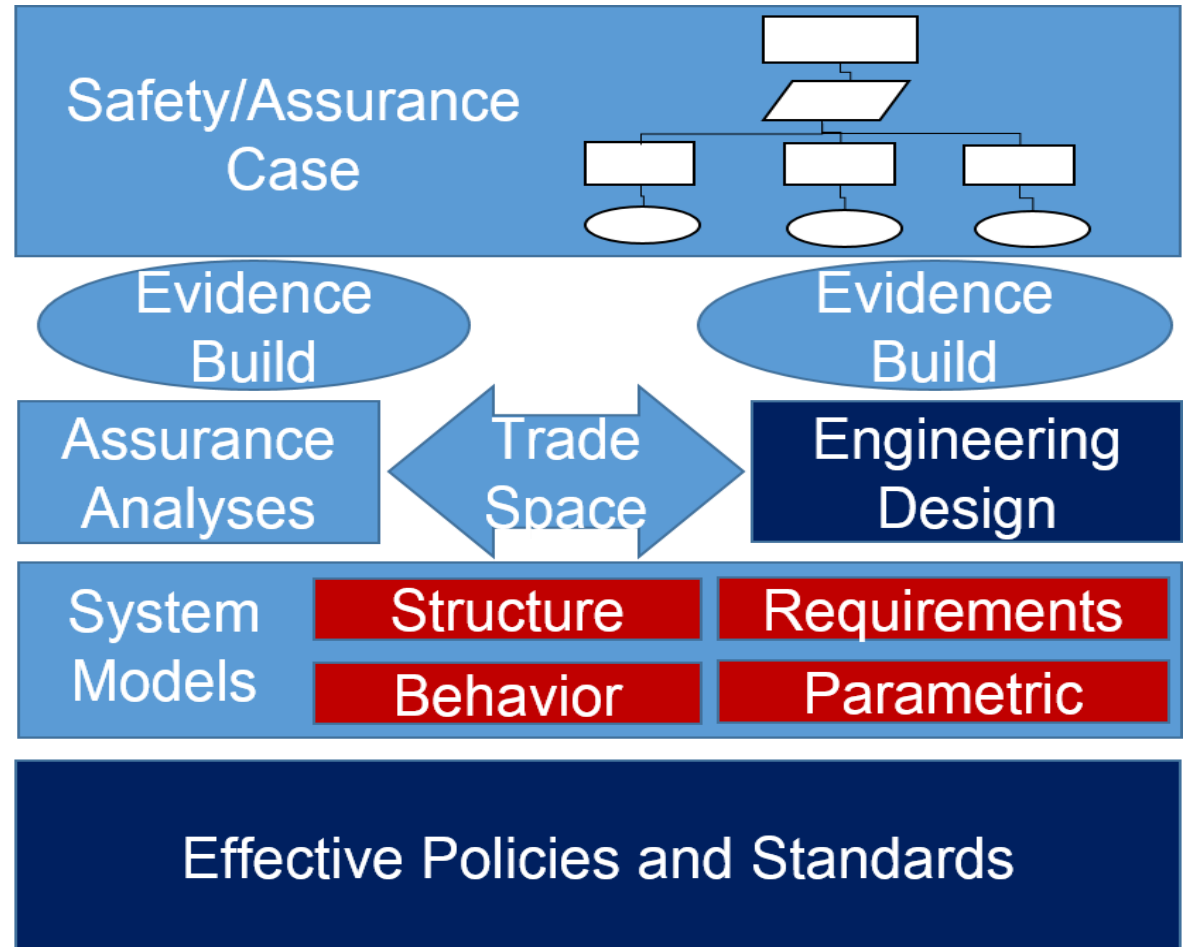
- Introduction
- Background
  - NASA OSMA MBMA Program
  - Aspects of NASA Quality Assurance
- Thrust 1: Representing S&MA in the model
  - Examples and Illustrations of MBQA
- Thrust 2: “Lowering the barrier” to interacting with the model
- Summary and Conclusions
- Acknowledgements

# Introduction

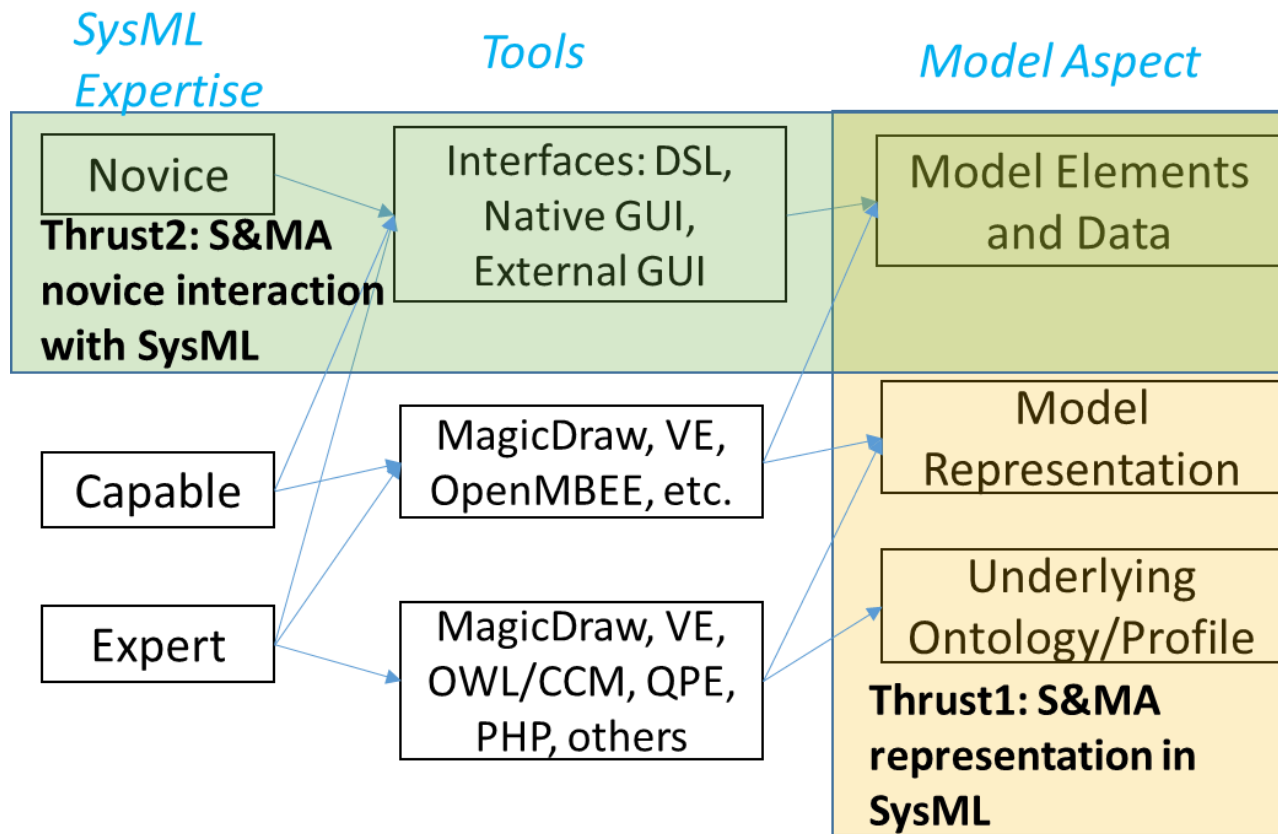
# Background

## NASA OSMA's Model-Based Mission Assurance (MBMA) Program

The NASA OSMA MBMA Program is committed to developing effective Policies and Standards which will enable the rest of the Safety & Mission Assurance discipline.



# MBMA Program Thrusts for FY19/20



1. Representing S&MA, or interfaces to S&MA, in the SysML model
2. Enabling more interaction (viewing, editing) with the model without tool expertise

# Background

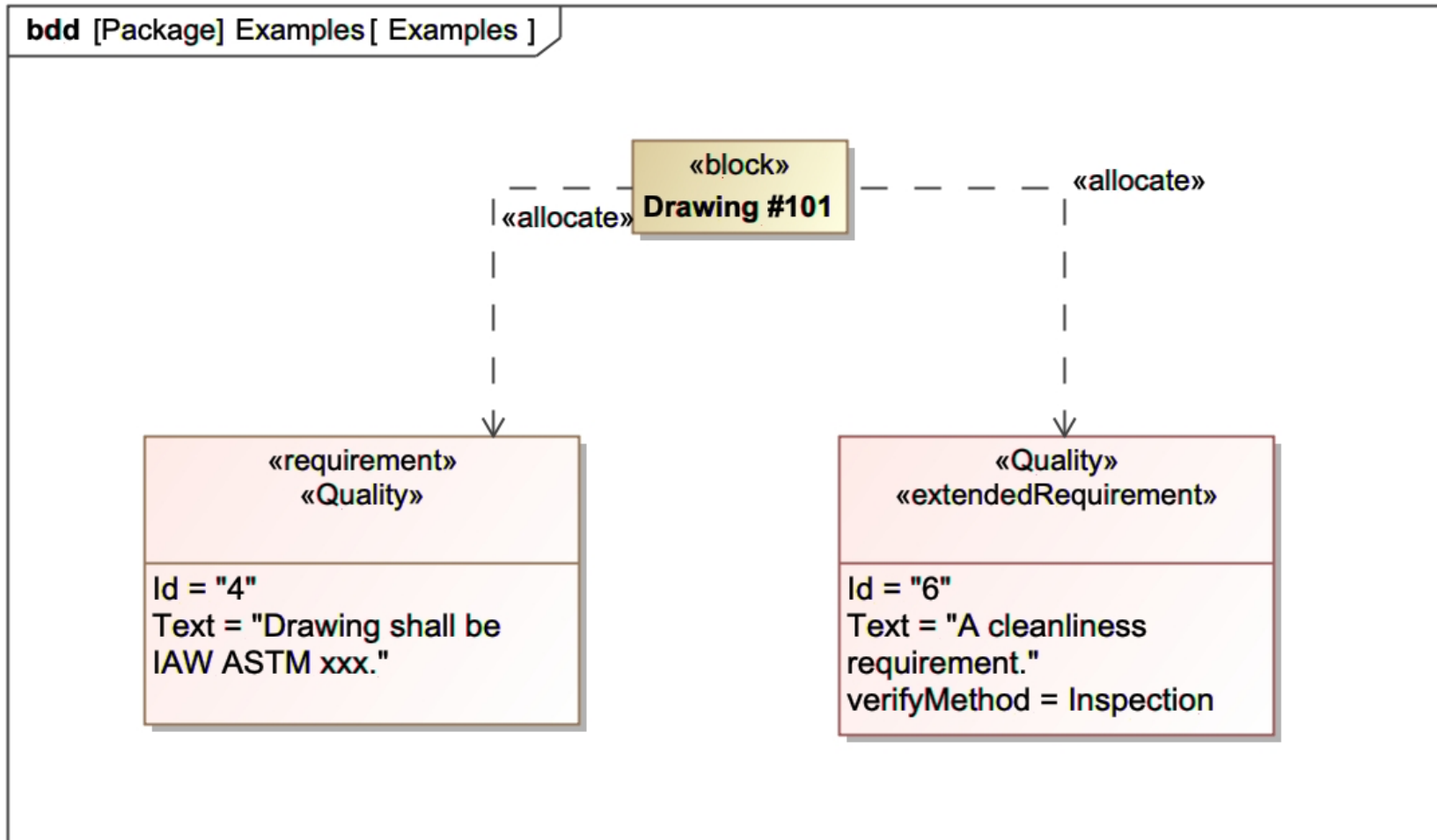
Key Requirements are established early in the life cycle

- Procurement and Contract Quality Assurance Requirements
  - Identification and Traceability
  - Control of Fabrication Activities
  - Contamination Control
  - Electrostatic Discharge Prevention
  - Nonconformance and Problem Reporting and Control
  - Inspection and Test of Stored Limited-Life Hardware
  - Handling, Preservation, Marking, Packaging, Packing, and Transportation
  - Acceptance Data Package (Preparation or review)
  - Control of Quality Records
  - Verification activities
  - Quality Assurance Audits

*“In the first 10% of any project, 80% of the resources are committed and 90% of all the risks are established (whether they are known or not)” - Anonymous*

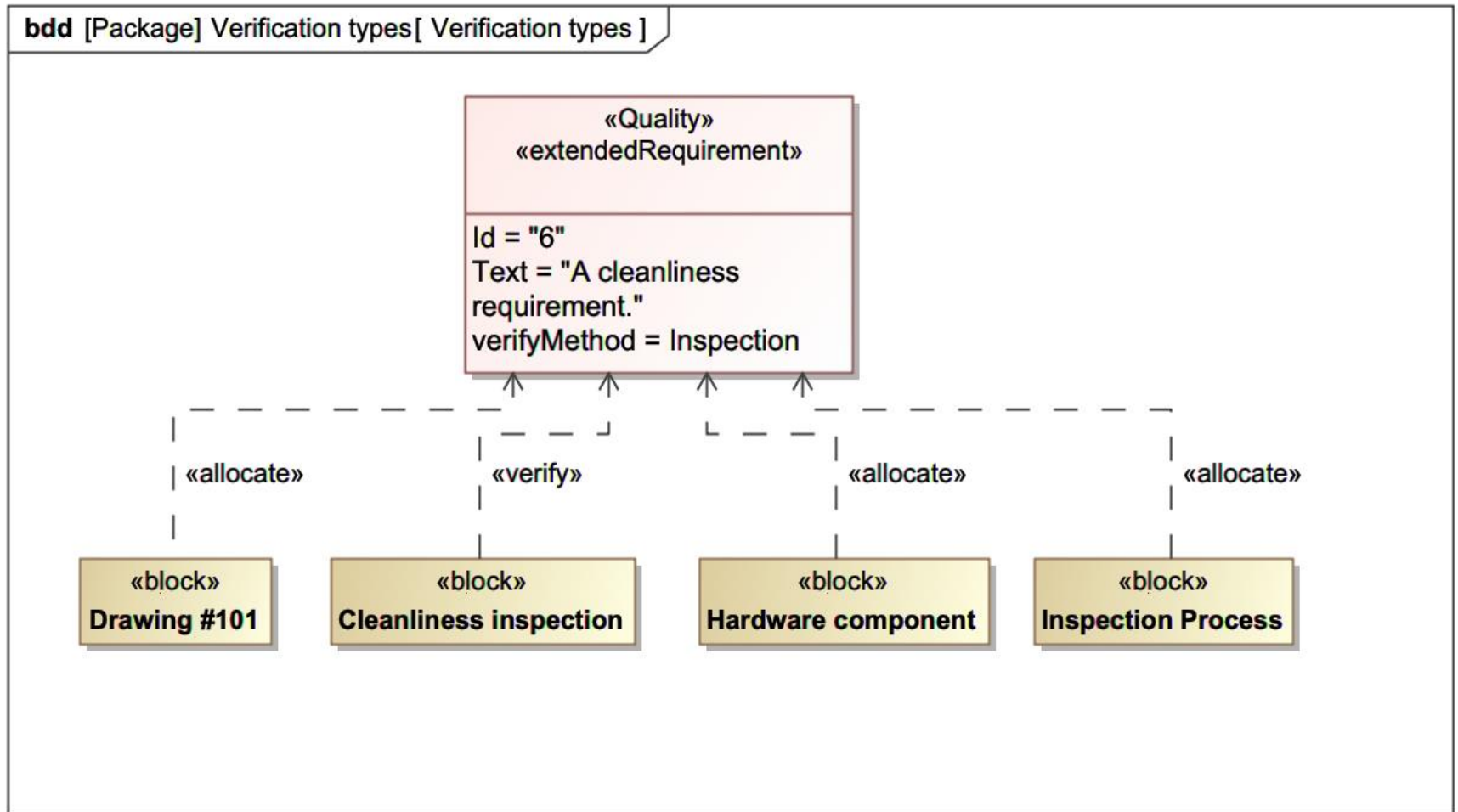
# Examples of MBQA

Specific relationships to model various aspects of a model element



# Examples of MBQA

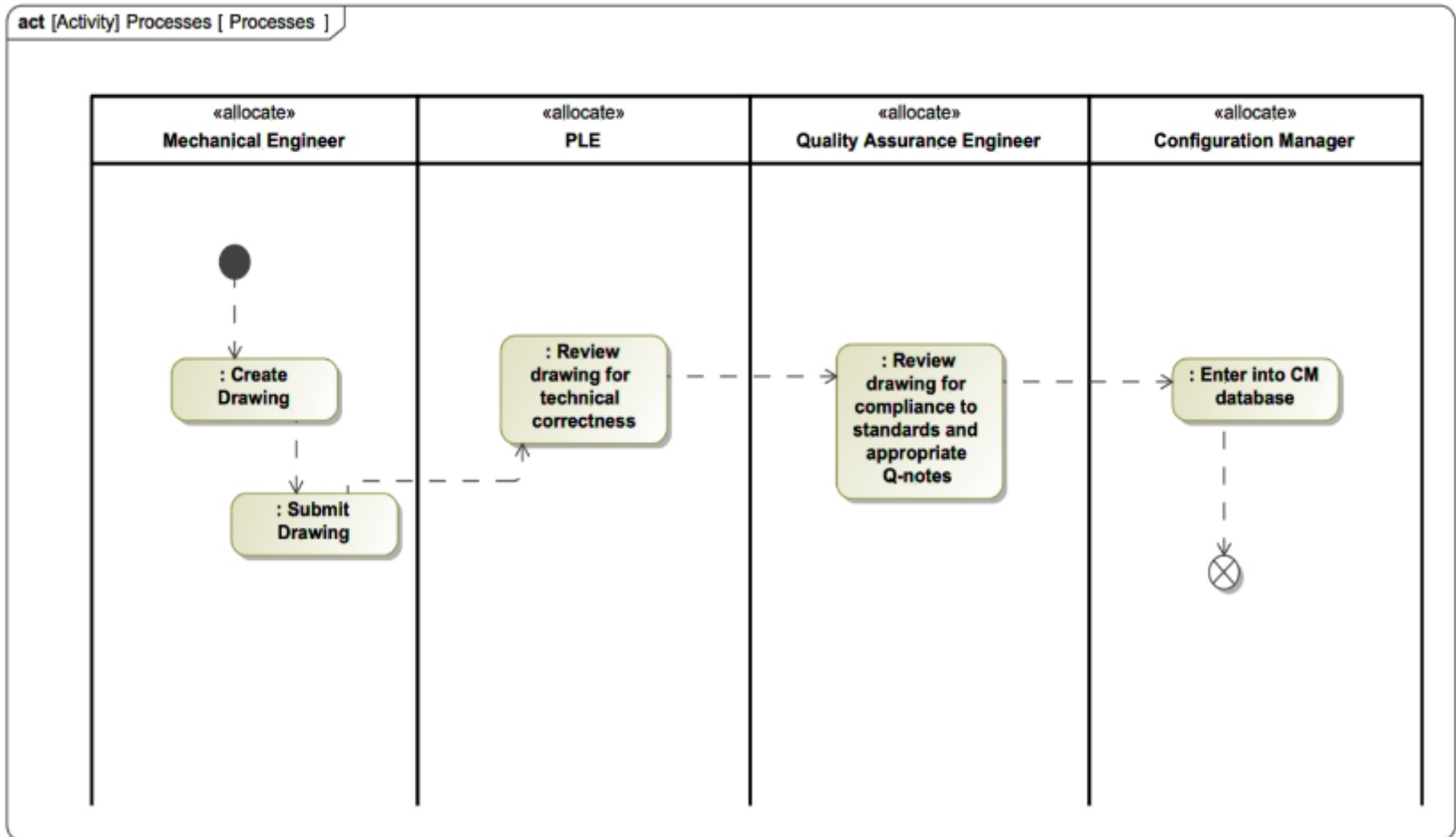
## Illustration of Verification Types for Quality Requirement





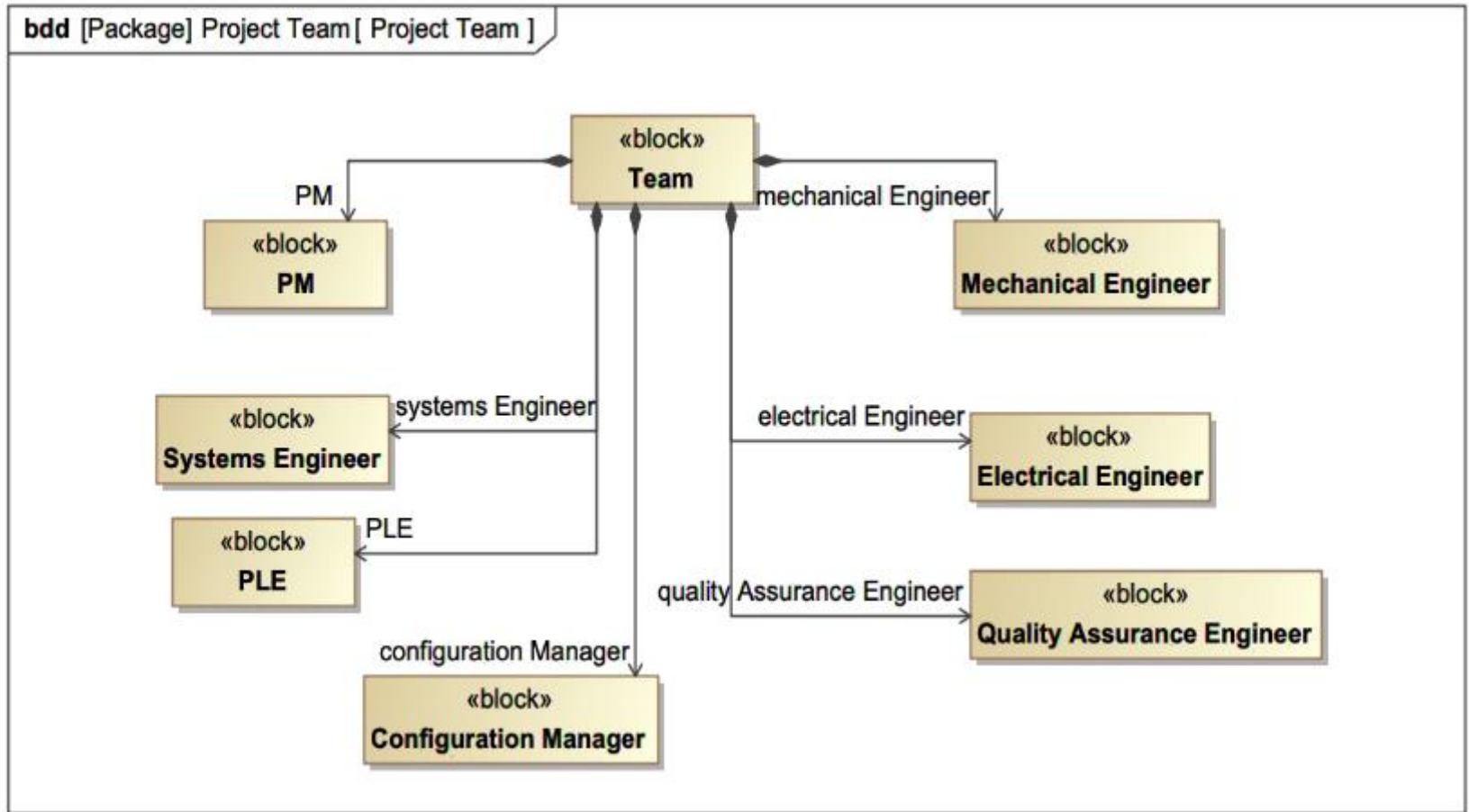
# Examples of MBQA

Swimlanes can clearly articulate responsibility in a context



# Examples of MBQA

Teams (and their properties) can also be modeled



# Implementing MBMA in FY20

- A variety of Use Cases identified in FY19 MBMA Workshop for key NASA Disciplines:
  - Quality Assurance, Software Assurance, Reliability Engineering and System Safety
  - Ranged across 3 levels: Summary-level, User-level and Sub-function levels
  - Great training in Use Cases by Kurt Woodham (LaRC), based on material from Alistair Cockburn
- Preparing for FY20 MBMA Workshop
  - Focus is on Implementing Use Cases relevant to early life-cycle (MCR, SRR)
  - Focus is on generating needed S&MA products for real-life missions. Down-select to a few key pilot efforts.
  - Will continue to generate and review products thru FY20
  - Have a real (or at least mock) SRR to review and evaluate products
  - Use this review and feedback to guide the FY21 MBMA Workshop focus

# Summary and Conclusions

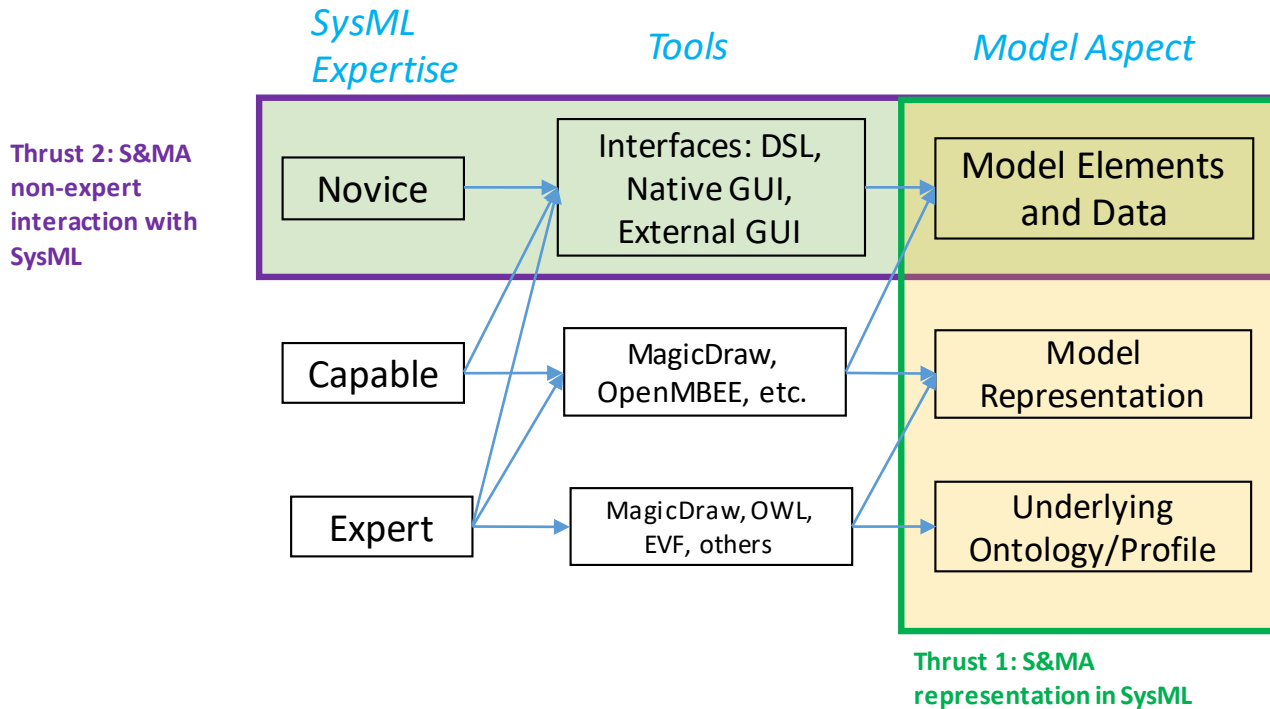
- Model Based Systems Engineering (MBSE) has shown value to systems engineering
- Aim: translate that value to Safety and Mission Assurance (S&MA)
  - Define S&MA processes
  - Produce S&MA products
  - Represent S&MA disciplines
- Interfaces to SE discipline will require some MB [??]
- Our approach:
  - Identify Quality Assurance Use Cases – done!
  - Implement them – underway
  - Deploy them into pilot and project efforts - future

# Acknowledgements

This research was carried out at:

- NASA/Goddard Space Flight Center
- NASA John H. Glenn Research Center
- NASA Office of Safety and Mission Assurance
- The Jet Propulsion Laboratory, California Institute of Technology under a contract with the National Aeronautics and Space Administration

# NASA OSMA MBMA: Main Thrusts for FY19



# Another Example of Structure (and Inheritance)

A Project team *is composed of* these members. They are all part of the QLM Project Users

A Project team *inherits* some properties from being a member of Project Folks (eg. Project Role)

A Project SMA/QA team also *inherits* some properties from being a member of S&MA Folks (eg. Discipline)

Both Project Folks and S&MA Folks *inherit* some properties from being a member of NASA Folks (eg. Name, ID)

