11 April 2022

13 - Elements, Properties, and Stereotypes

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**Purpose of this Memo**

To make the case for updating CSRM stereotypes. Once agreement is reached, updates to the CSRM Specification will be developed.

This is a big deal and needs lots of discussion.

Figures 1 lists CSRM element stereotypes. Black font denotes current baseline as captured in the normative CSRM Profile. Blue font denotes recommended additions.

Figure 2 lists requirement elements related properties that are part of the SysML language.

Figure 3 illustrates one of many ways to establish relationships between the mission stakeholders, requirements, technical measures, and use cases stereotypes. These stereotypes are denoted by italicized font in Figure 1.

The relationships are captured in the element specifications and are displayed and maintained in diagrams and tables as shown in Figure 1.

**Object Constraint Language**

There has been discussion about codifying the allowable relationships using Object Constraint Language (OCL). OCL is a declarative language describing rules applying to Unified Modeling Language (UML) models. For example, a refine relationship can exist between a requirement. and any other model element, whereas a derive relationship can only exist between requirements.

That could be done founded on the examples in Figure 3. This would be of limited benefit. A mission team will be using the stereotypes and relationships best suited to their mission and the stereotypes in Figure 3 are very limited as compared to Figure 1.

A case could be made to established relationships for the stereotypes in Figure 1. But that is out-of-Scope for the SSWG CSRM effort.

**An Issue that Needs Resolution.**

The intent of defining addition stereotypes as shown in Figure 1 is to provide stereotypes for a variety of mission architectures. However, several of the stereotypes are identified as CubeSat stereotypes. But they are not unique to CubeSats. The only thing that makes a model a CubeSat model is the incorporation of a CubeSat form factor such as the Cal Poly CubeSat Design Specification.

My recommendation is to rename the stereotypes as show in Table 1 below.

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*Stakeholder*

*StakeholderConcern*

*MissionNeed*

*MissionObjective*

*MissionConstrain*t

*Mission Requirement*

*SegmentRequirement*

SpaceSegmentRequirement

CubeSatRequirement

GroundSegmentRequirement

*SubsystemRequirement*

CubeSatSubsystemRequirement

GroundSubsystemRequirement

ComponentRequirement

CubeSatComponentRequirement

GroundComponentRequirement

SpacecraftRequirement

SatelliteRequirement

DeployerRequirement

*moeSpecification*

*mopSpecification*

*tpmSpecification*

kppSpecification

moeRequirement

mopRequirement

tpmRequirement

kppRequirement

EnterpriseUseCase

*MissionUseCase*

*SegmentUseCase*

SpaceSegmentUseCase

CubeSatUseCase

GroundSegmentUseCase

*SubsystemUseCase*

CubeSatSubsystemUseCase

GroundSubsystemUseCase

ValidationActivity

VerificationActivity

Mission

Domain

Enterprise

System

Spacecraft

Satellite

Segment

SpaceSegment

CubeSat

GroundSegment

Subsystem

CubeSatSubsystem

GroundSubsystem

Component

CubeSatComponent

GroundComponent

Facility

Equipment

**Figure 1. CSRM Stereotypes**

Refines

RefinedBy

TracedTo

TracedFrom

Derived

DerivedFrom

AllocatedTo

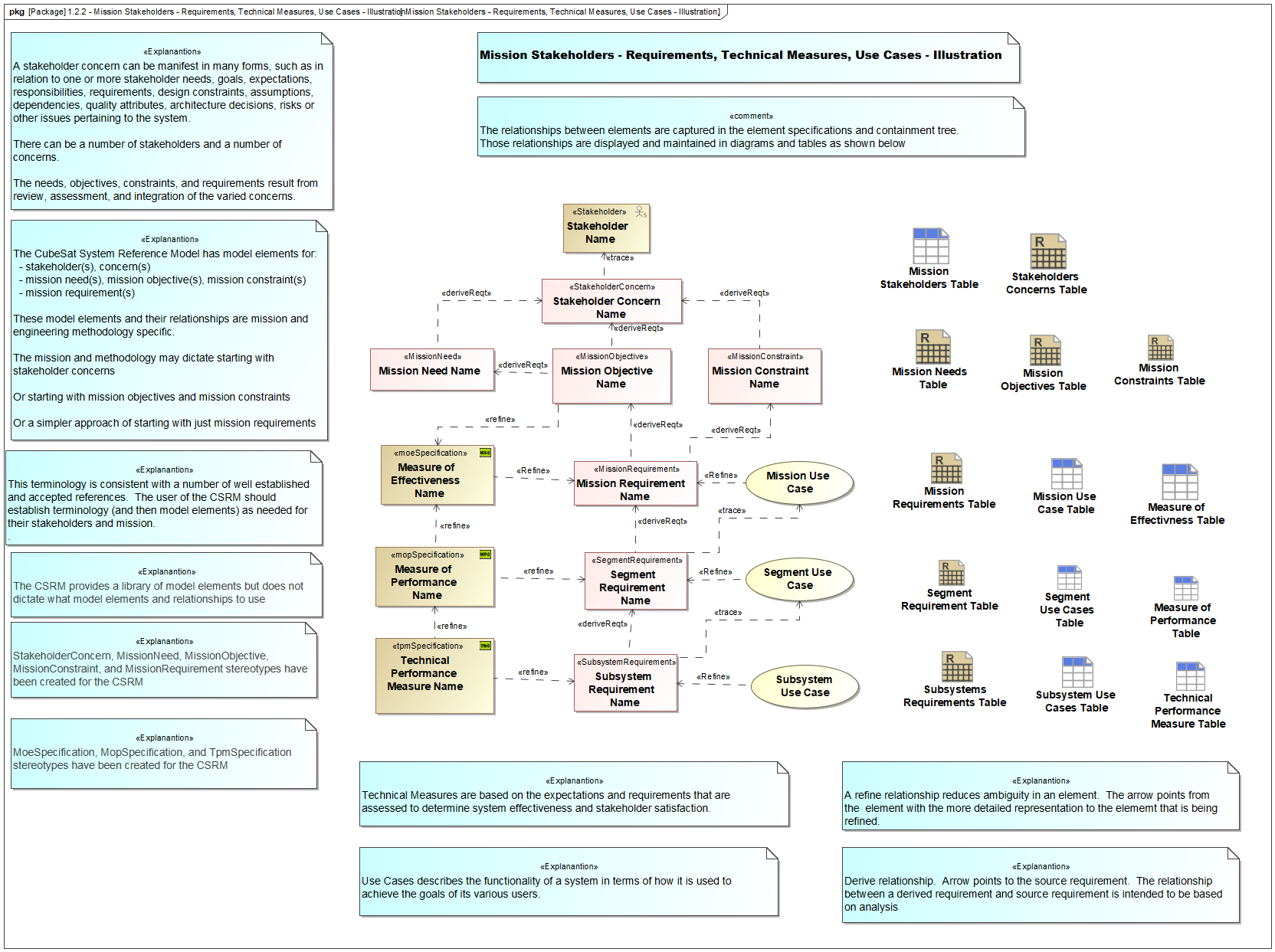
AllocatedFrom

ValidatedBy

VerifiedBy

SatisfiedBy

**Figure 2. Requirements Related Properties**



**Figure 3. Mission Stakeholders – Requirement, Technical Measures, Use Cases - Illusion**

|  |  |
| --- | --- |
| **Replace** | **With** |
| CubeSatRequirement | SatelliteRequirement |
| CubeSatSubsystemRequirement | SatelliteSubsystemRequirement |
| CubeSatComponentRequirement | SatelliteComponentRequirement |
| CubeSatUseCase | SatelliteUseCase |
| CubeSatSubsystemUseCase | SatelliteSubsystemUseCase |
| **Table 1. Renaming of Stereotypes** | |

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