

# The Development and Application of the F Prime MagicDraw Plug-In User Handbook

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## Overview

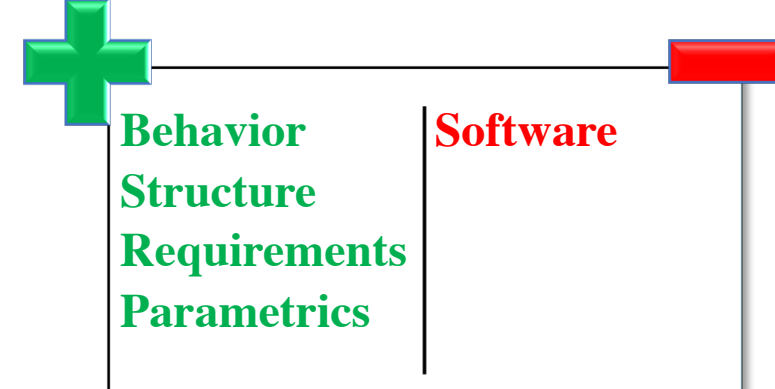
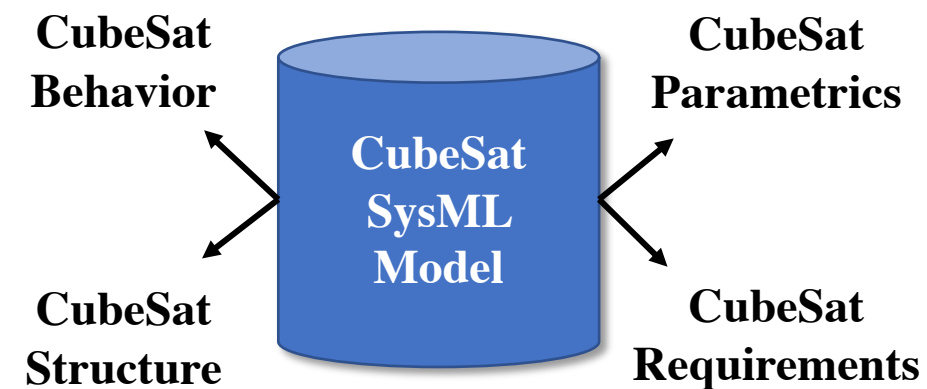
- Model-Based Systems Engineering (MBSE) leverages modeling languages, such as SysML, and tools, such as MagicDraw, to capture and maintain CubeSat design, but neglects CubeSat software.
- F Prime, an open-source software development framework developed at the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL), enables the modeling and generation of CubeSat software through a MagicDraw plug-in and profile.
- The joint application of F Prime modeling capabilities and traditional MBSE is explored through the development and application of an F Prime MagicDraw Plug-In User Handbook for the Alabama Experiment on Galactic-ray In-situ Shielding (AEGIS) project.

## 1.0 Problem: MBSE and CubeSat Software

SysML model provides a “single source of truth” for CubeSat design.

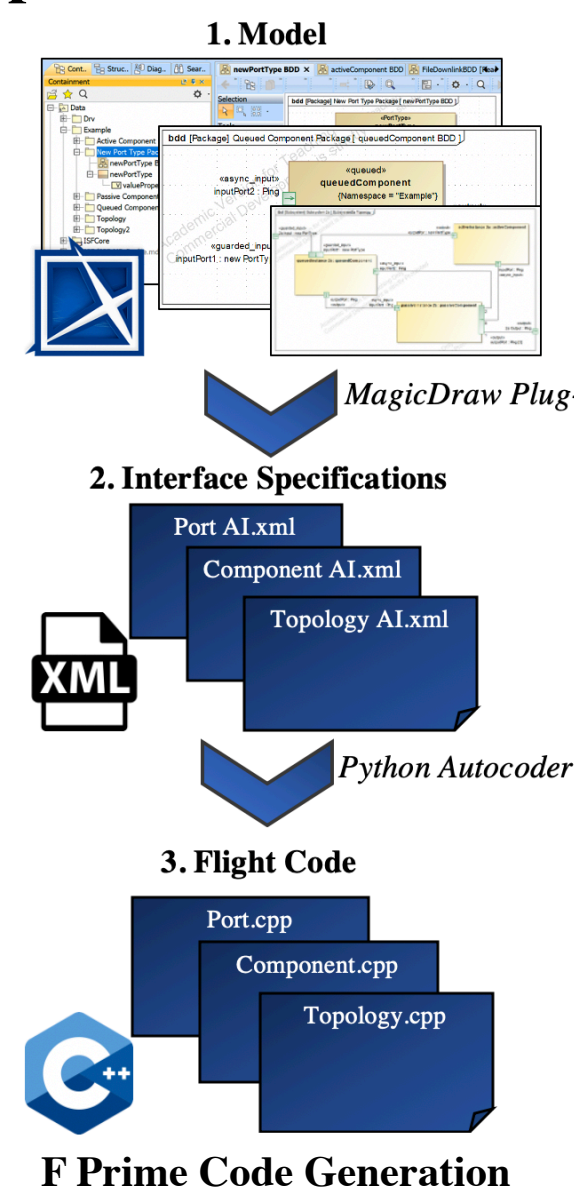
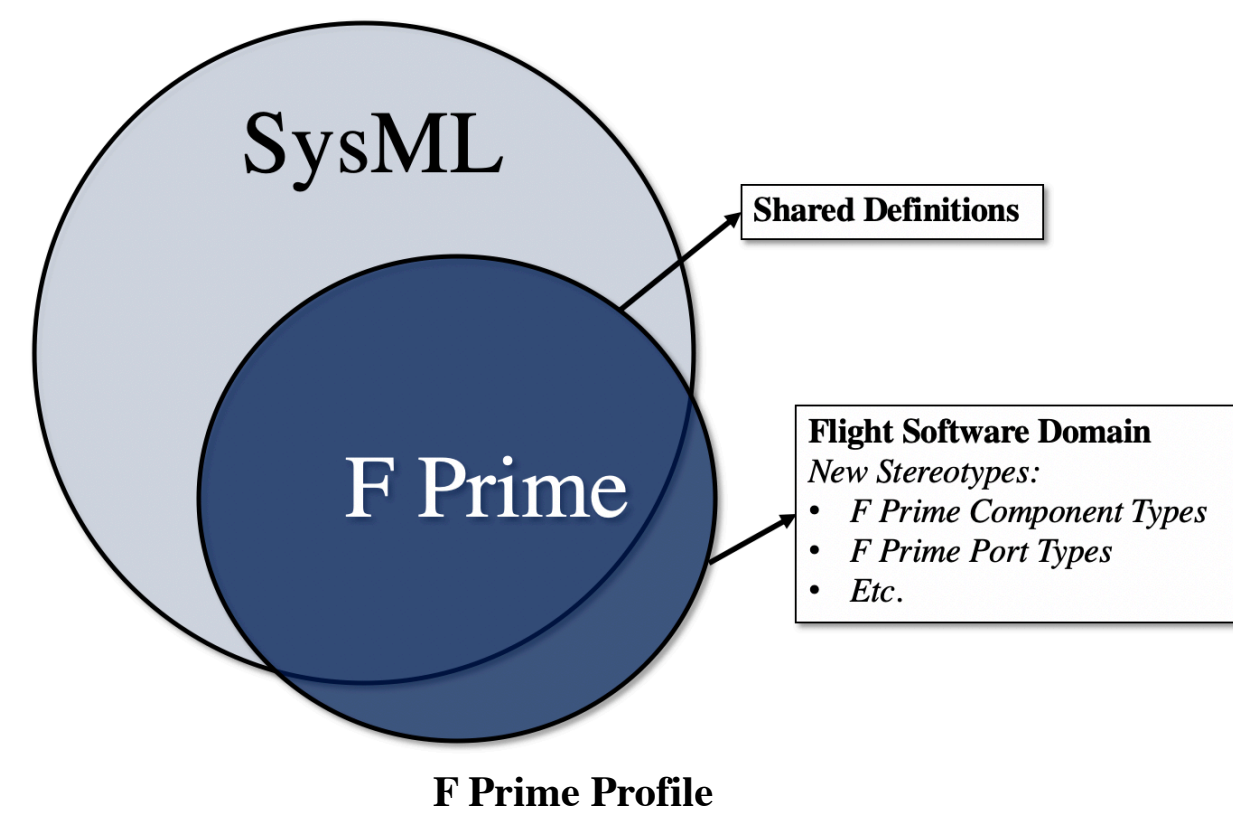


SysML does not provide a means for capturing CubeSat Software within the system model

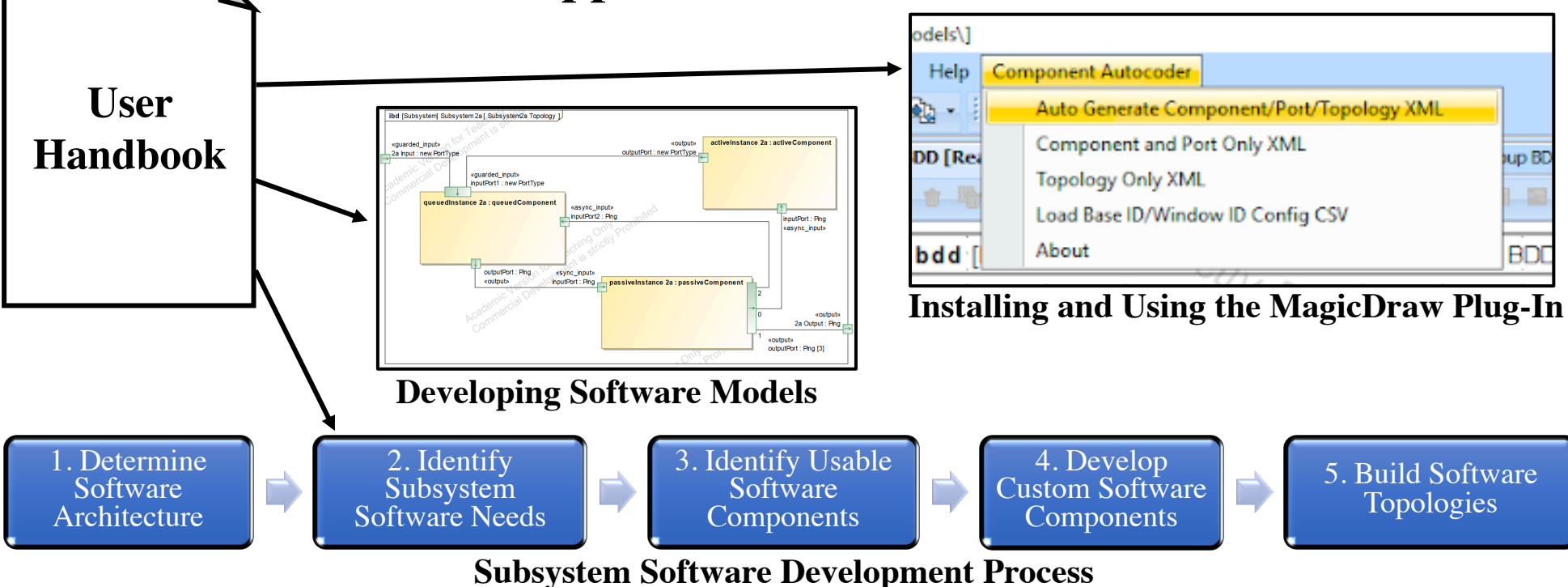


## 2.0 Solution: F Prime Modeling Capabilities

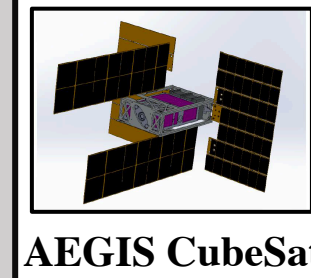
F Prime, an open-source framework developed at NASA's JPL, enables the modeling and generation of CubeSat flight software through a profile and code generation tools.<sup>1</sup>



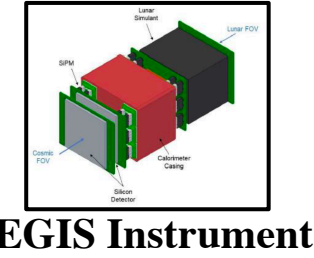
## 3.0 Approach: User Handbook



## 4.0 Handbook Application: AEGIS CubeSat



AEGIS CubeSat

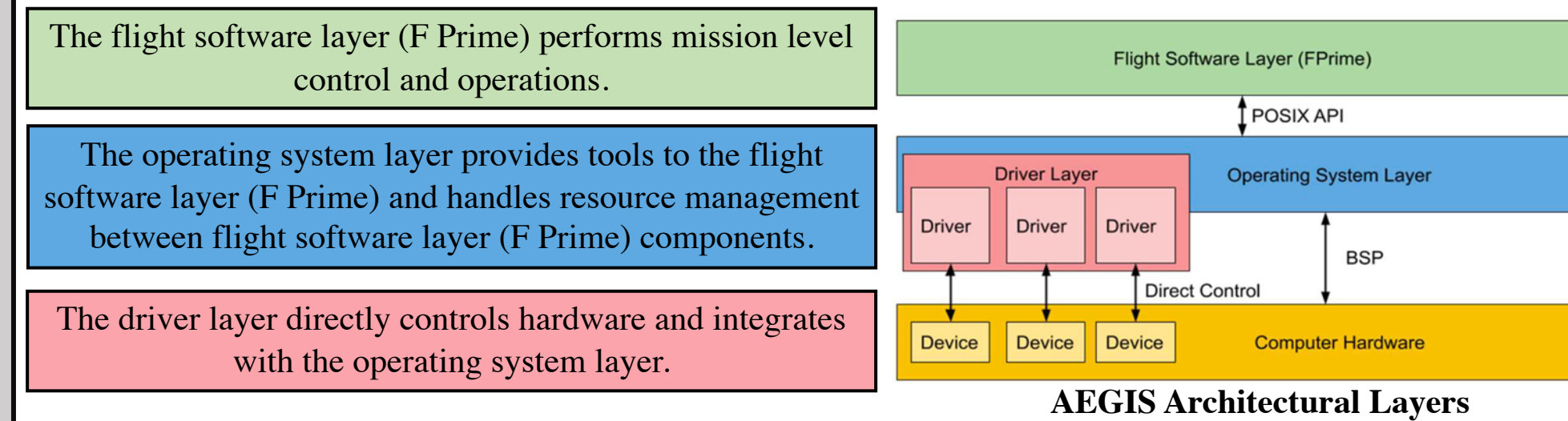


AEGIS Instrument

AEGIS is a 6U CubeSat currently under development and is part of the Alabama Space Grant Consortium's initiative to provide educational opportunities across the state of Alabama.



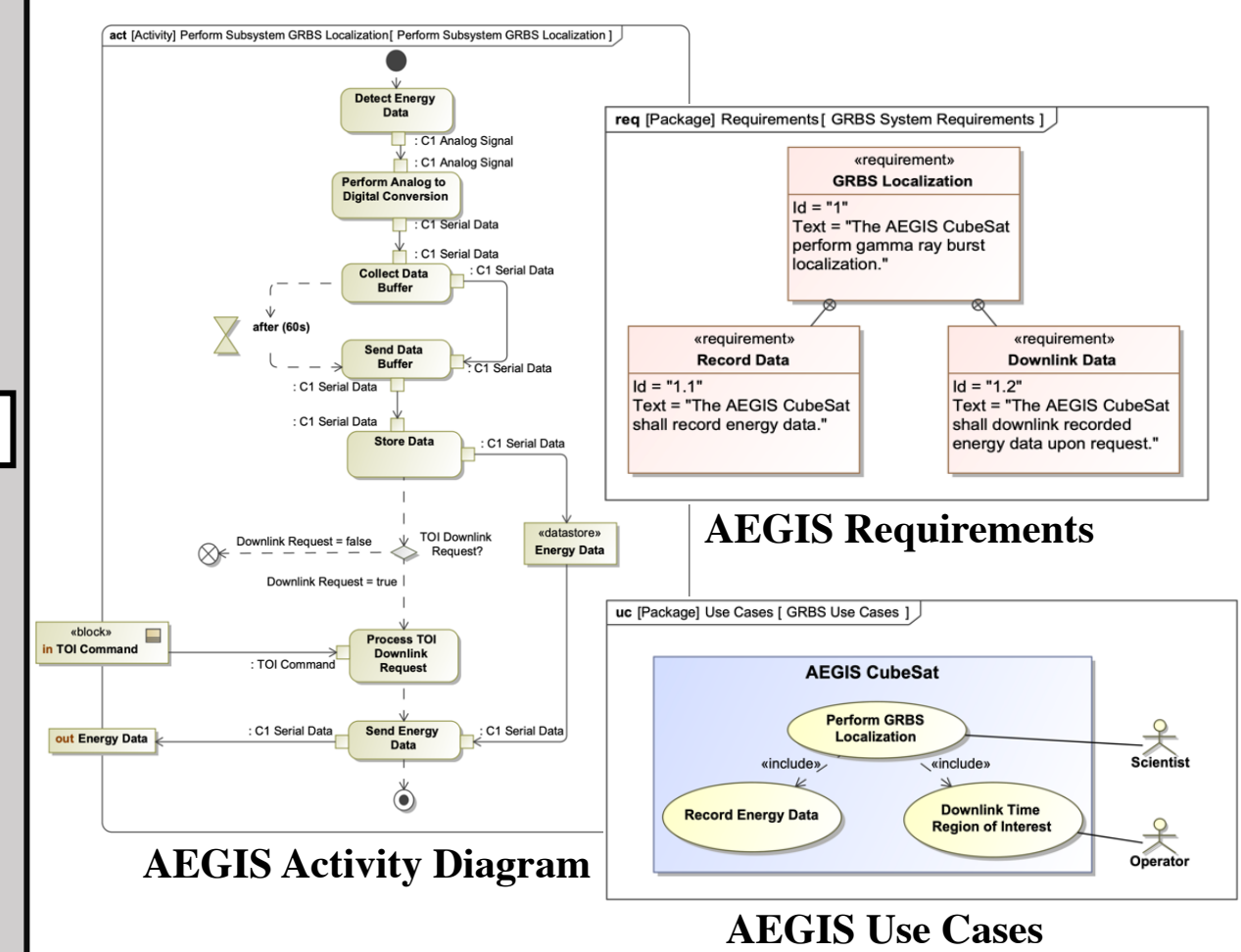
### 4.1 AEGIS Software Architecture



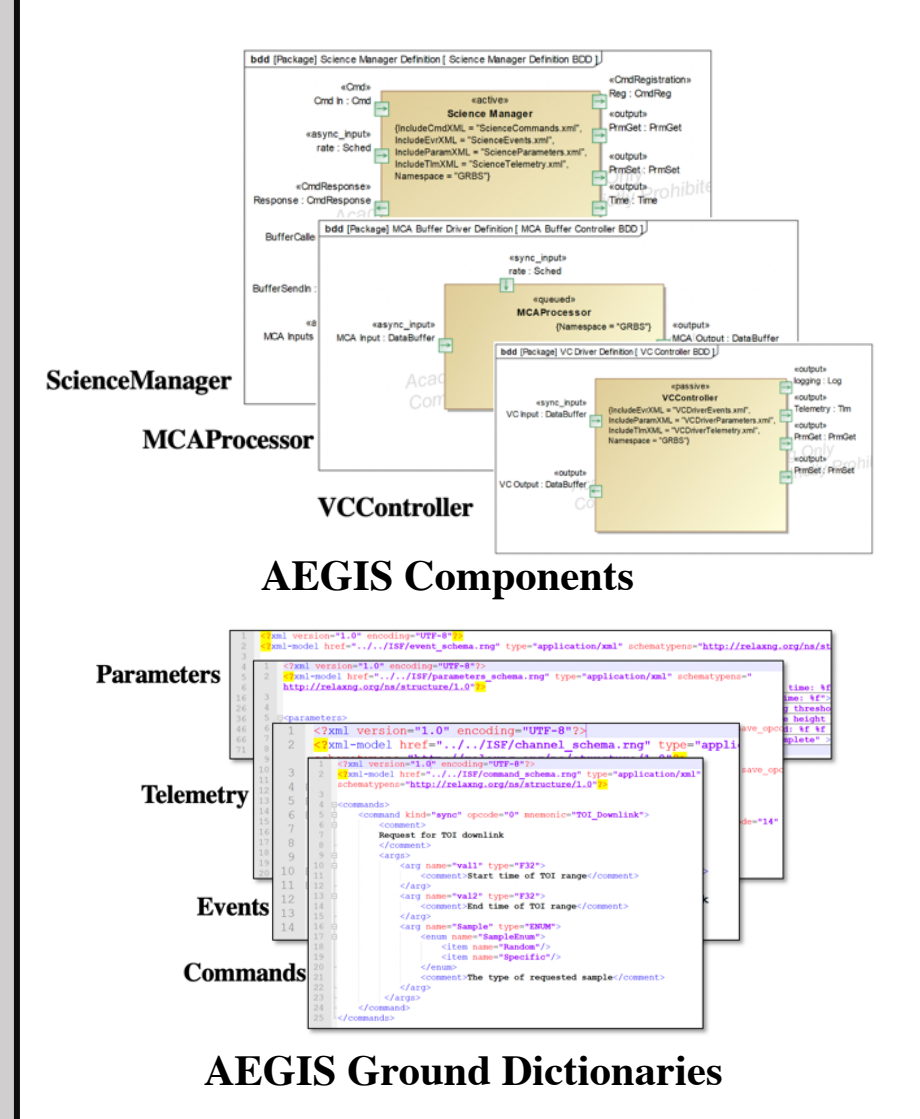
### 4.3 Usable F Prime Software Components for AEGIS

F Prime Usable Component
TlmChan
PrmDb
ActiveLogger
BufferManager
CommandDispatcher
GandIf
ActiveRateGroup
RateGroupDriver
Time

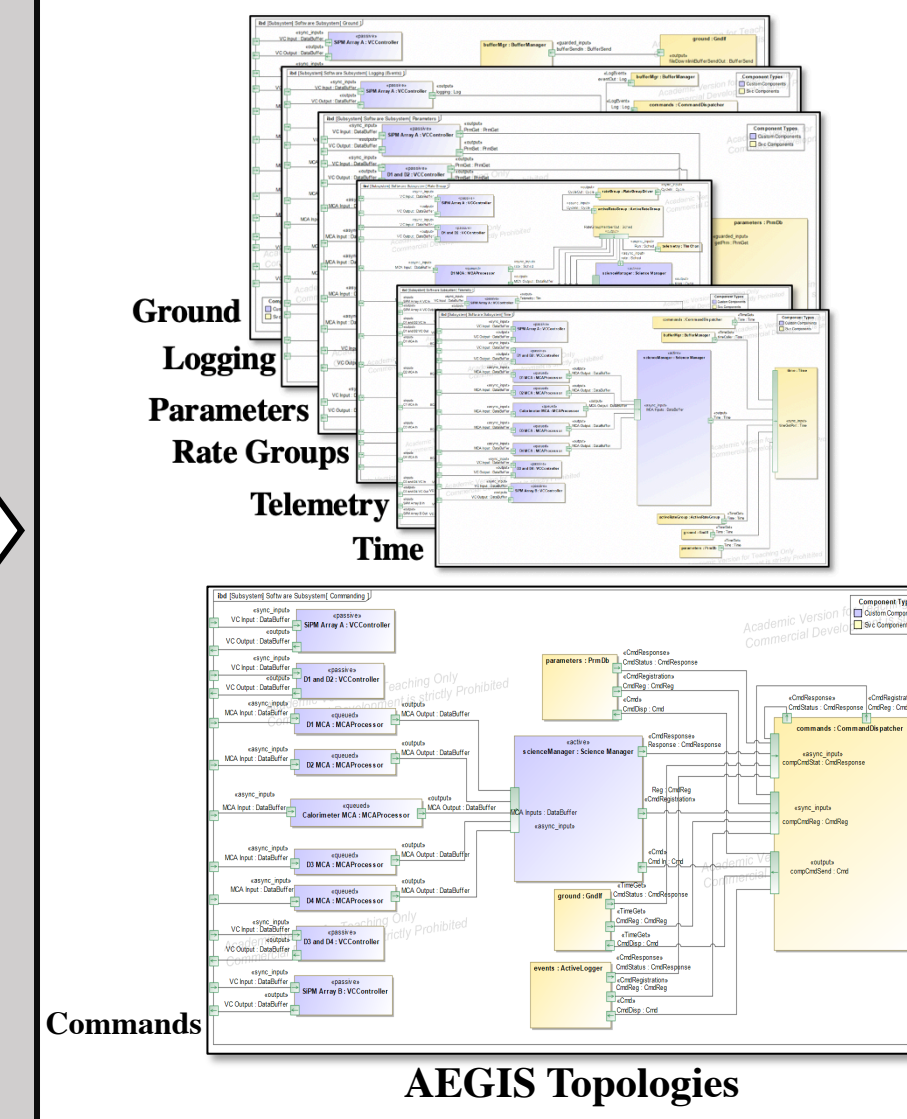
### 4.2 AEGIS Science Instrument Software Needs



### 4.4 AEGIS Custom Software Components

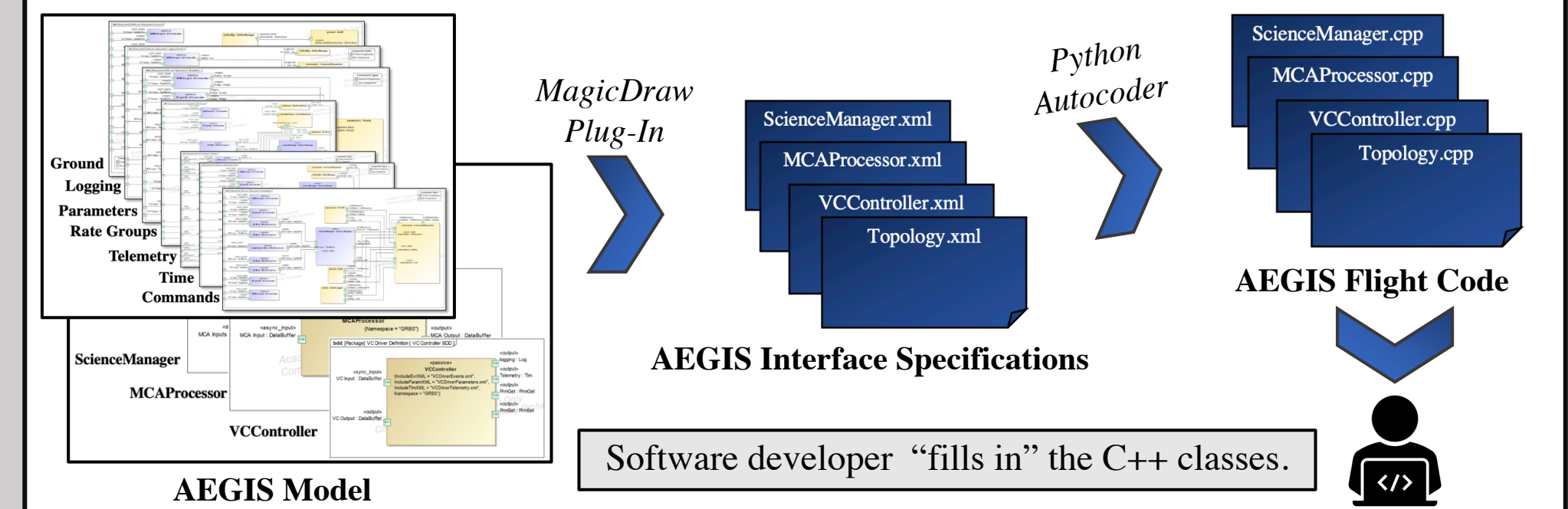


### 4.5 AEGIS Software Topologies



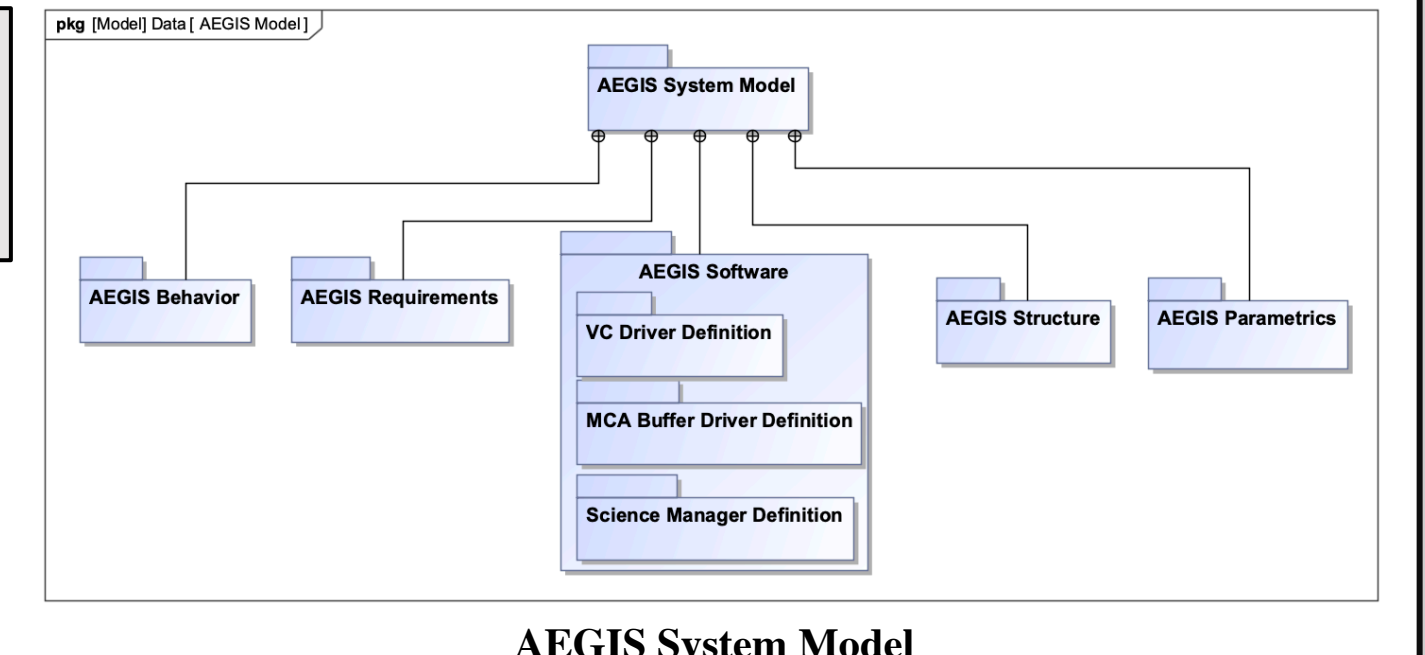
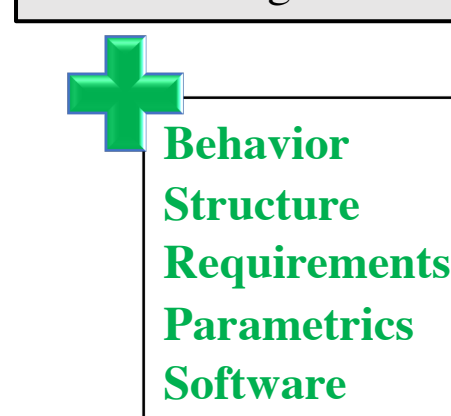
### 4.6 AEGIS Code Generation

At the conclusion of the modeling process, the F Prime MagicDraw Plug-In and Python Autocoder are used to generate Application Flight Code.

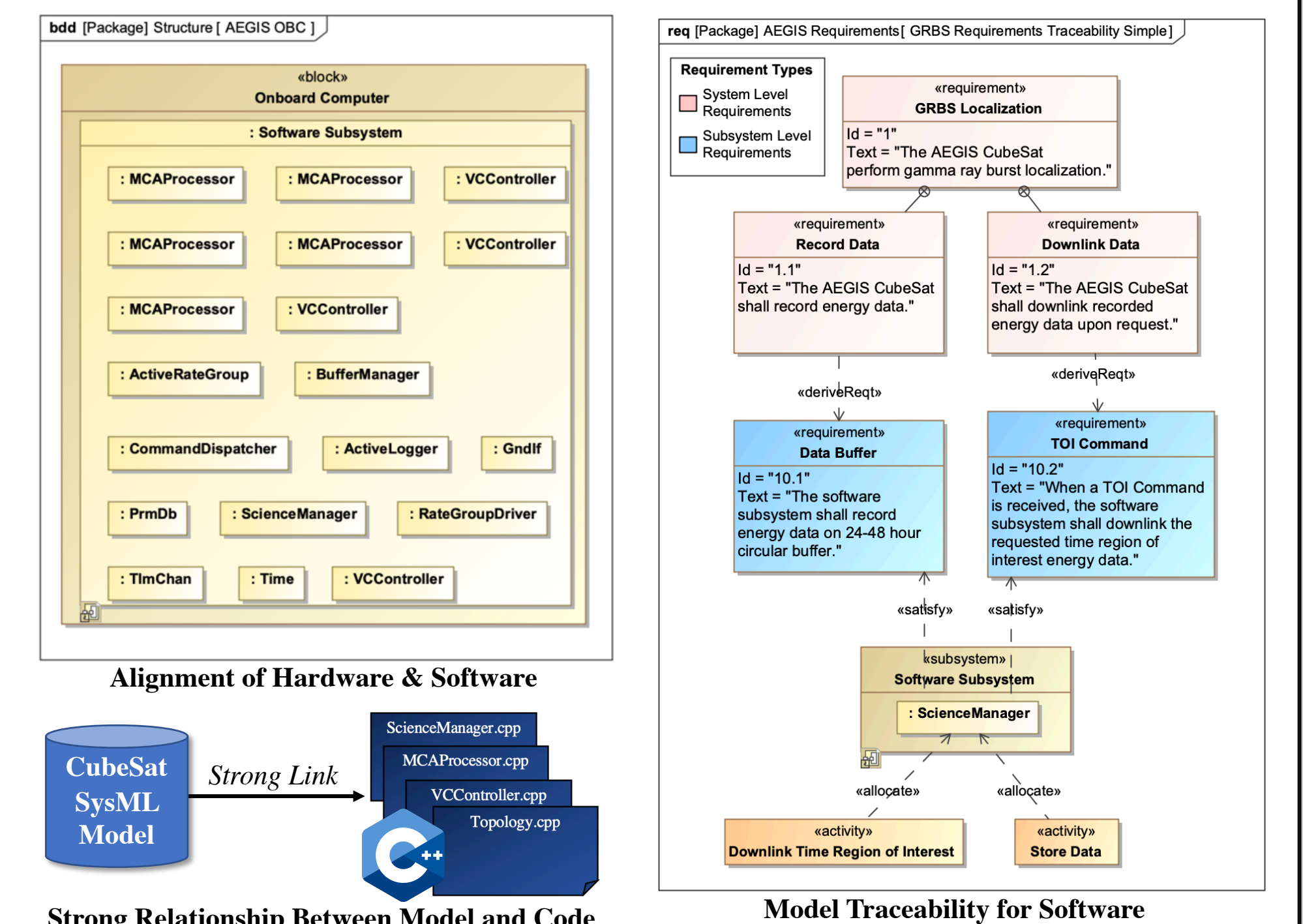


### 5.0 Conclusions

SysML and F Prime provide “Single Source of Truth” for CubeSat Design, including Software.



With the software captured in the model, many benefits can be realized.



### 6.0 References

1. Bocchino, Robert, “F Prime: An Open-Source Framework For Small-Scale Flight Software Systems,” 32nd Annual AIAA/USU Conference on Small Satellites.