

Capella for Modelling CubeSat: Tailored SE Process for Leveraging Model-Based Systems Engineering

Speakers

About BlueKei Solutions

BlueKei Solutions offers consultancy services for Enterprises and Startups, specializing in establishing Digital Engineering practices in organizations through Systems Engineering methodologies and MBSE.



Suvigya Gupta
MBSE Engineer

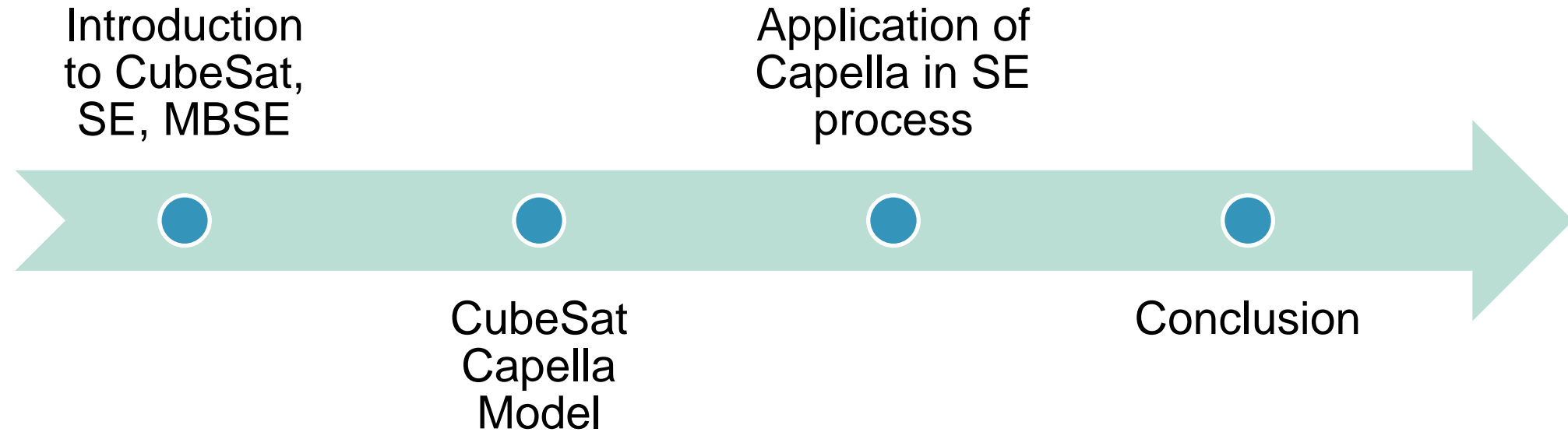


Dharendra Singh
MBSE Engineer



Stueti Gupta
Founder & Director

Outline



CubeSats today, in a nutshell

“small but clever”

Recent Developments:

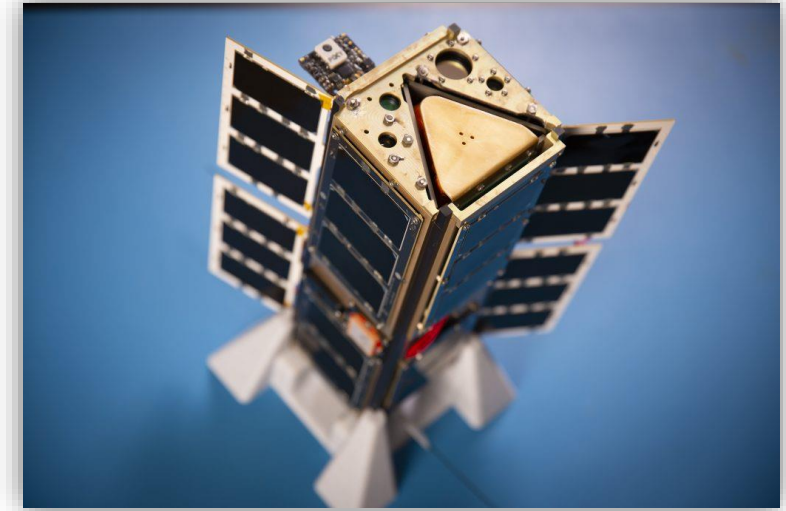
Swarm Missions

Interplanetary Missions

Commercialization and Standardization

Application: Design & operation of a CubeSat with weekly revisits to City A, City B, City C having a downlink station in City D.

- Weekly Revisits to each location
- Collect images for the region of interest for 40min
- Discontinuous Coverage
- No onboard intelligence



Picture Credit: NASA

Where lies the complexity?

Where lies the complexity?

CubeSat Mission

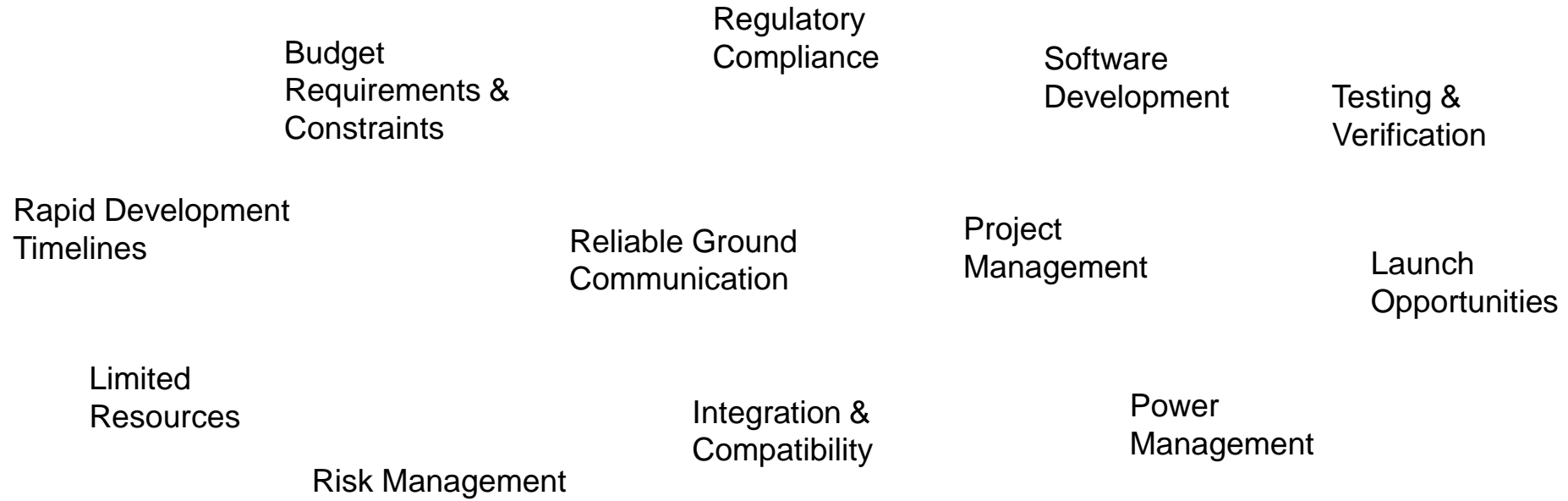
- Mission Objectives
- Launch & Deployment
- Operations & Data Management
- Autonomy and Error Handling
- Communication and Ground Stations
- Safety and Compliance

CubeSat as a 'System'

- Subsystem Integration
- Miniaturization
- Resource Constraints
- Testing and Verification
- Standardization and Compliance
- Multidisciplinary Team Coordination

To name a few..

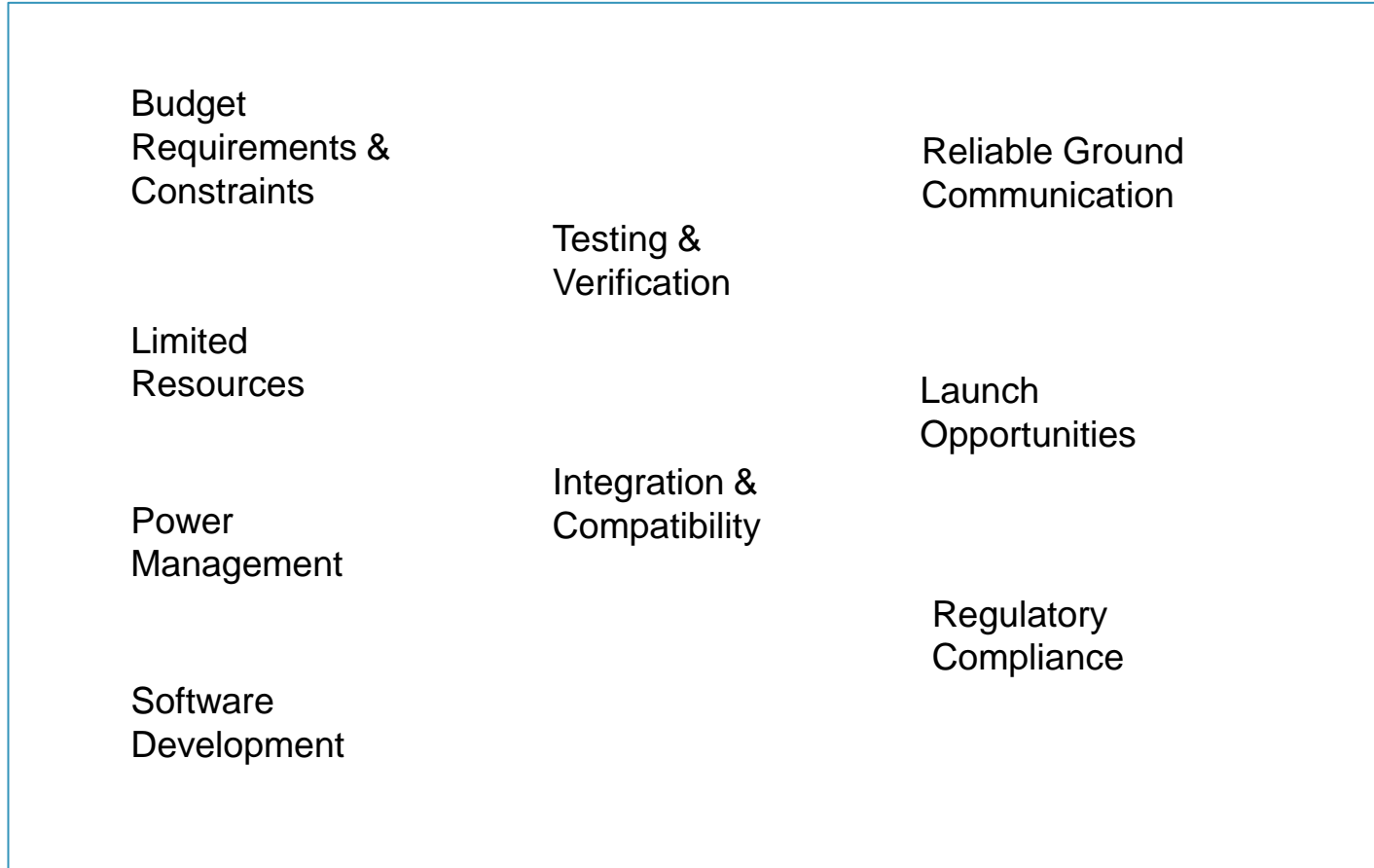
Common Challenges



How does SE and MBSE help manage complexity?

Common Challenges –SE Approach

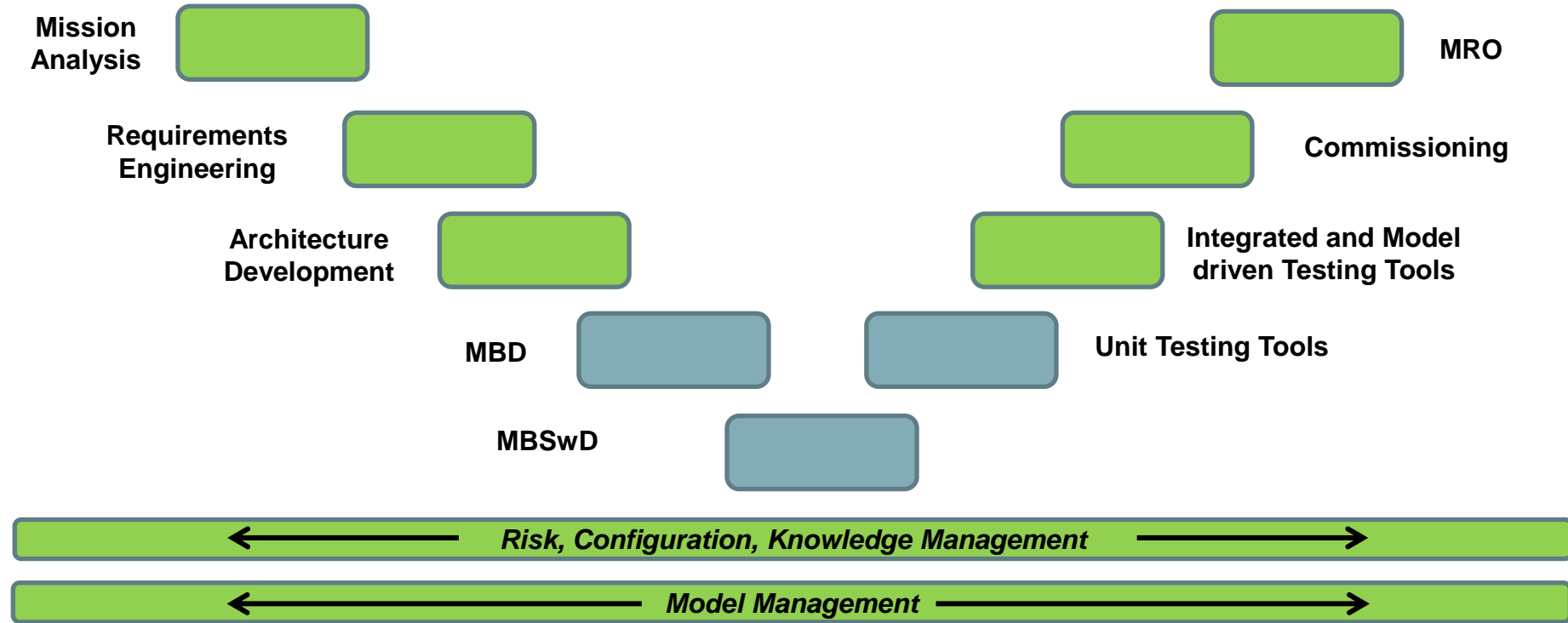
TECHNICAL CHALLENGES



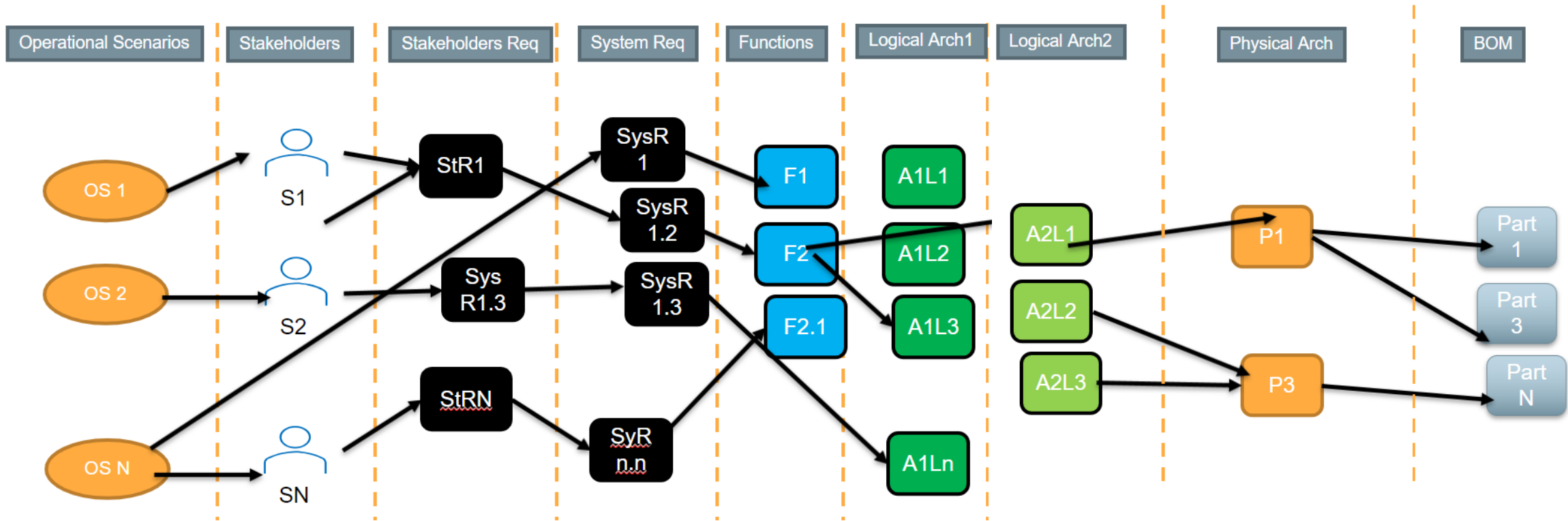
MANAGEMENT CHALLENGES



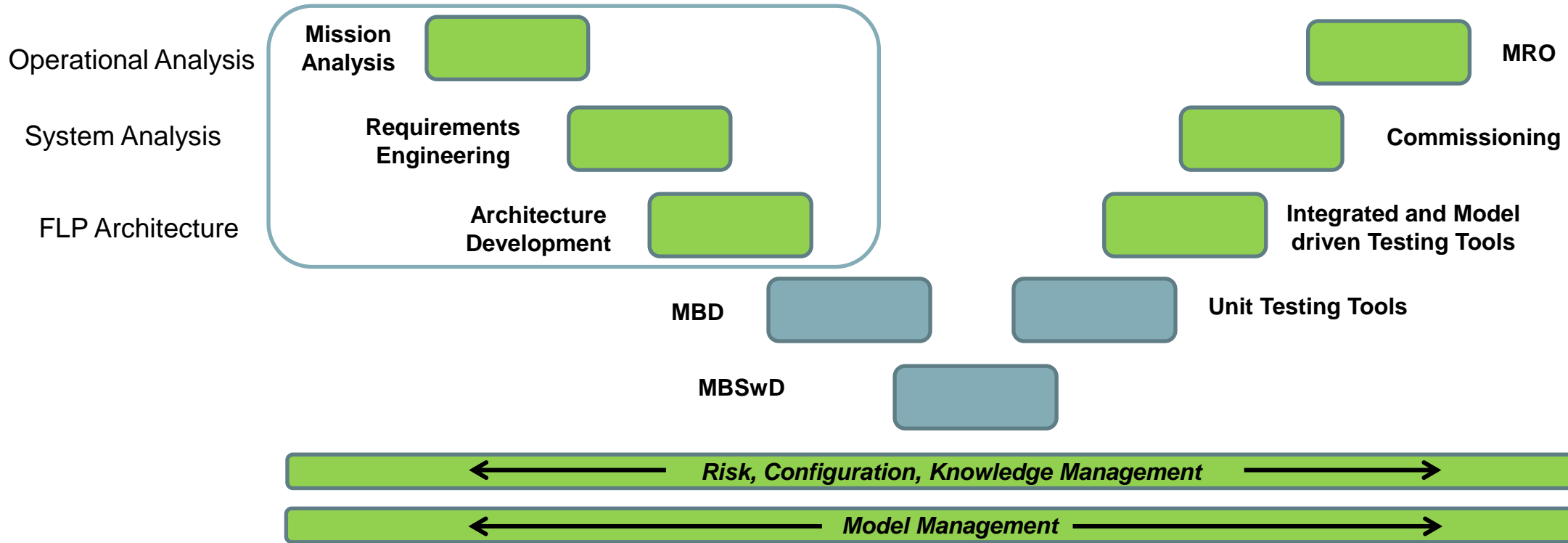
Vee Model



Digital Thread- Traceability



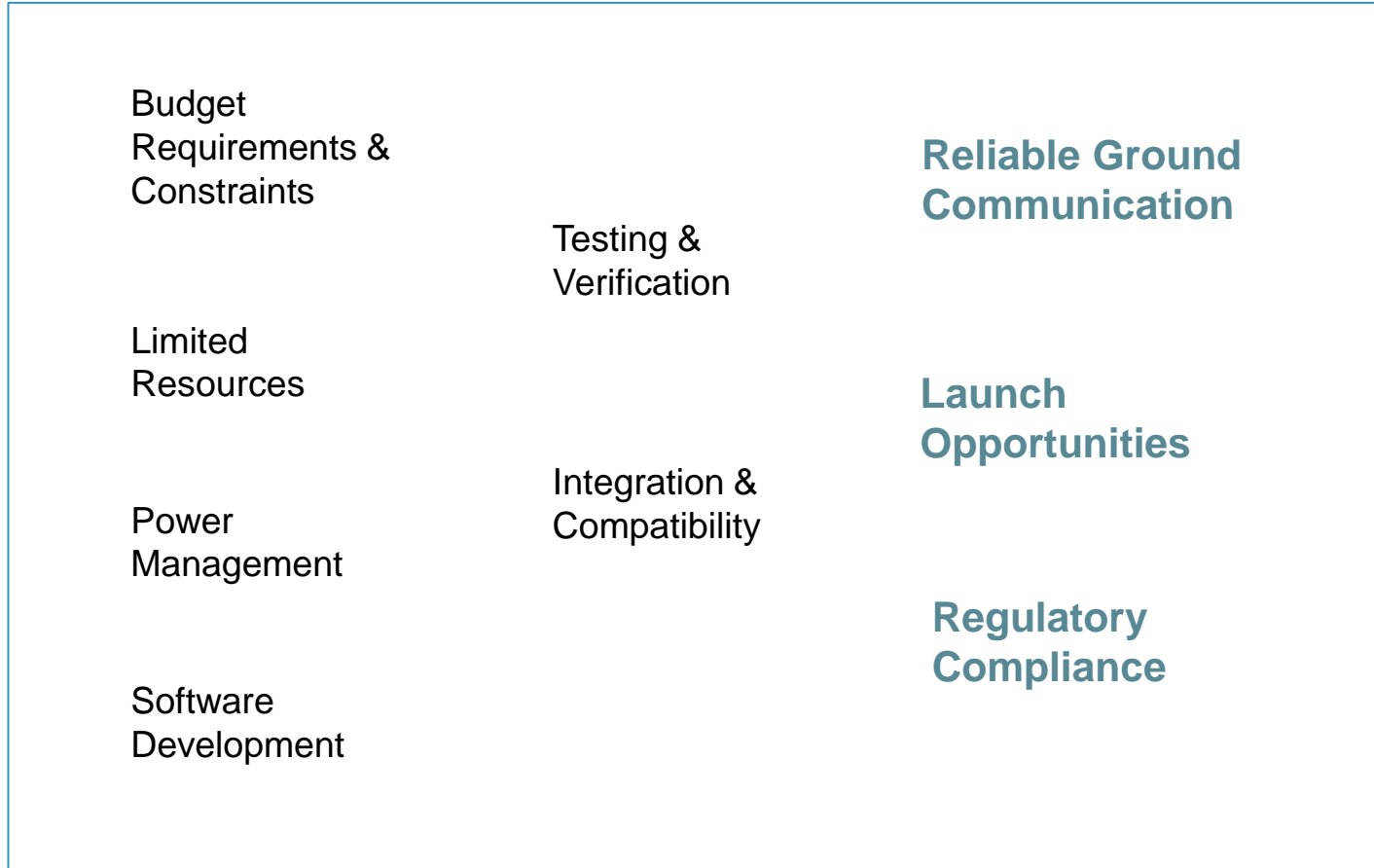
Scope of Modeling



How does system model contribute to dealing with the technical-management challenges?

Common Challenges

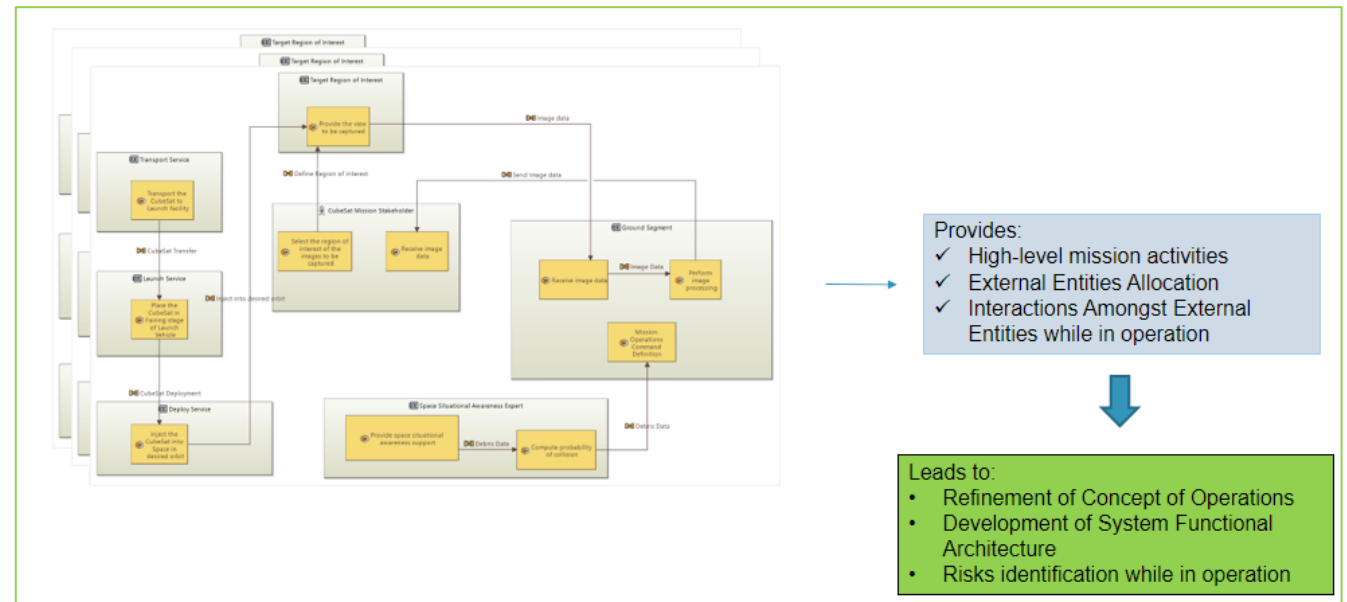
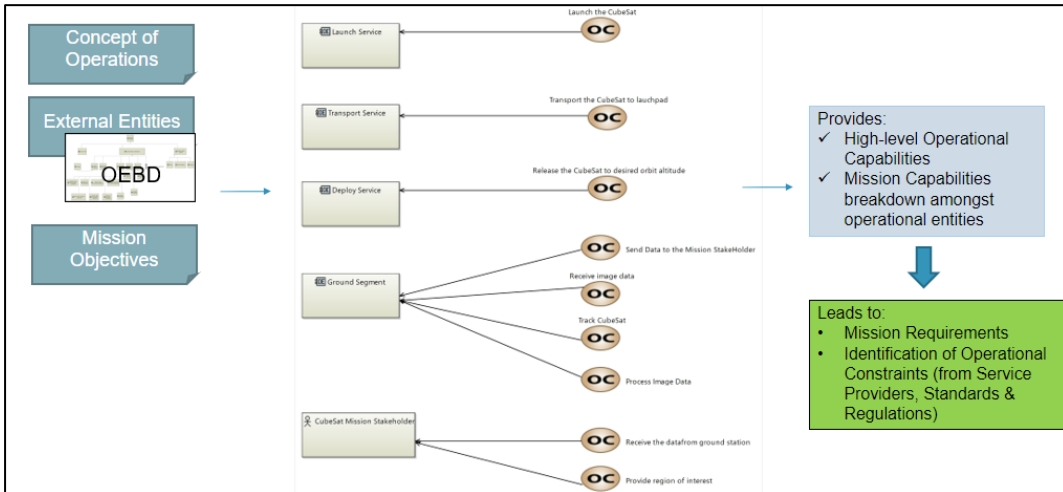
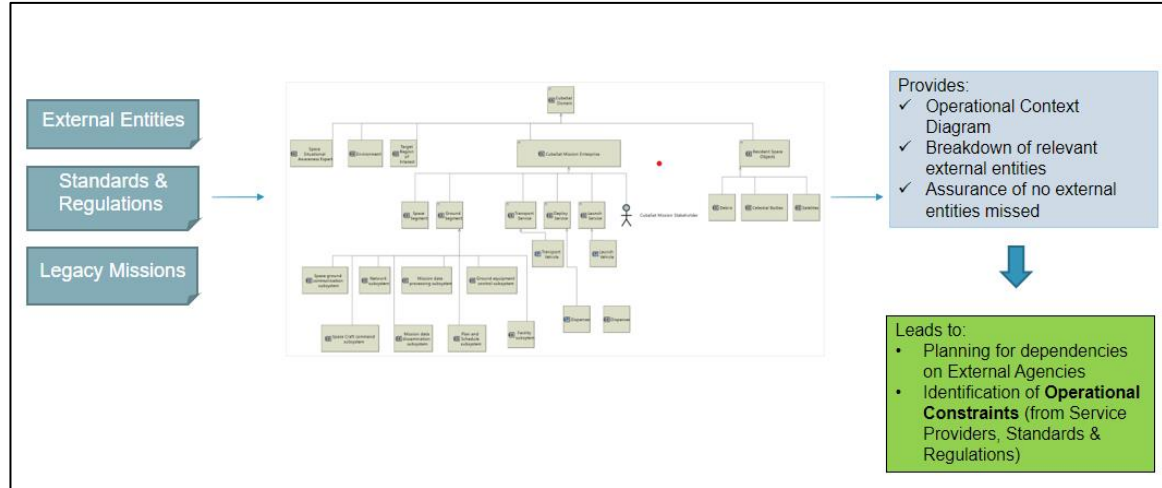
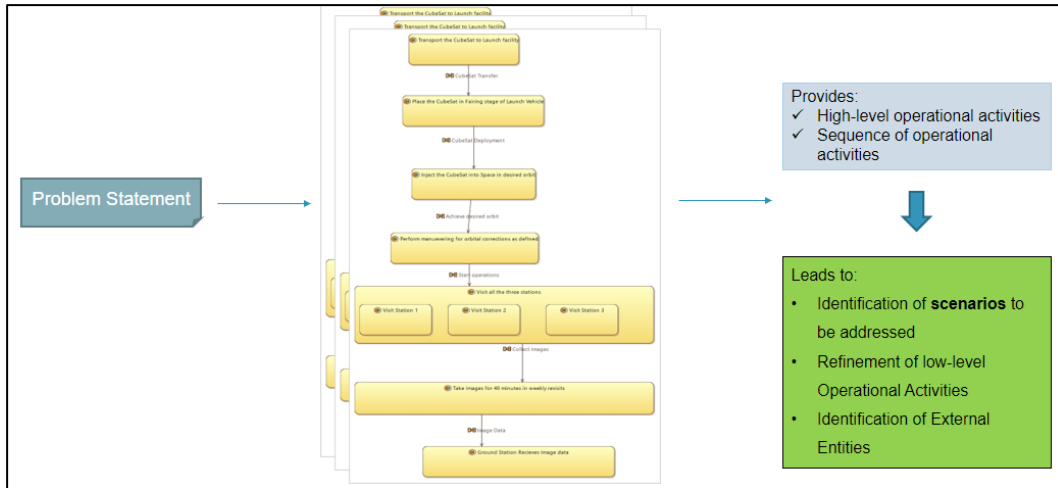
TECHNICAL CHALLENGES



MANAGEMENT CHALLENGES

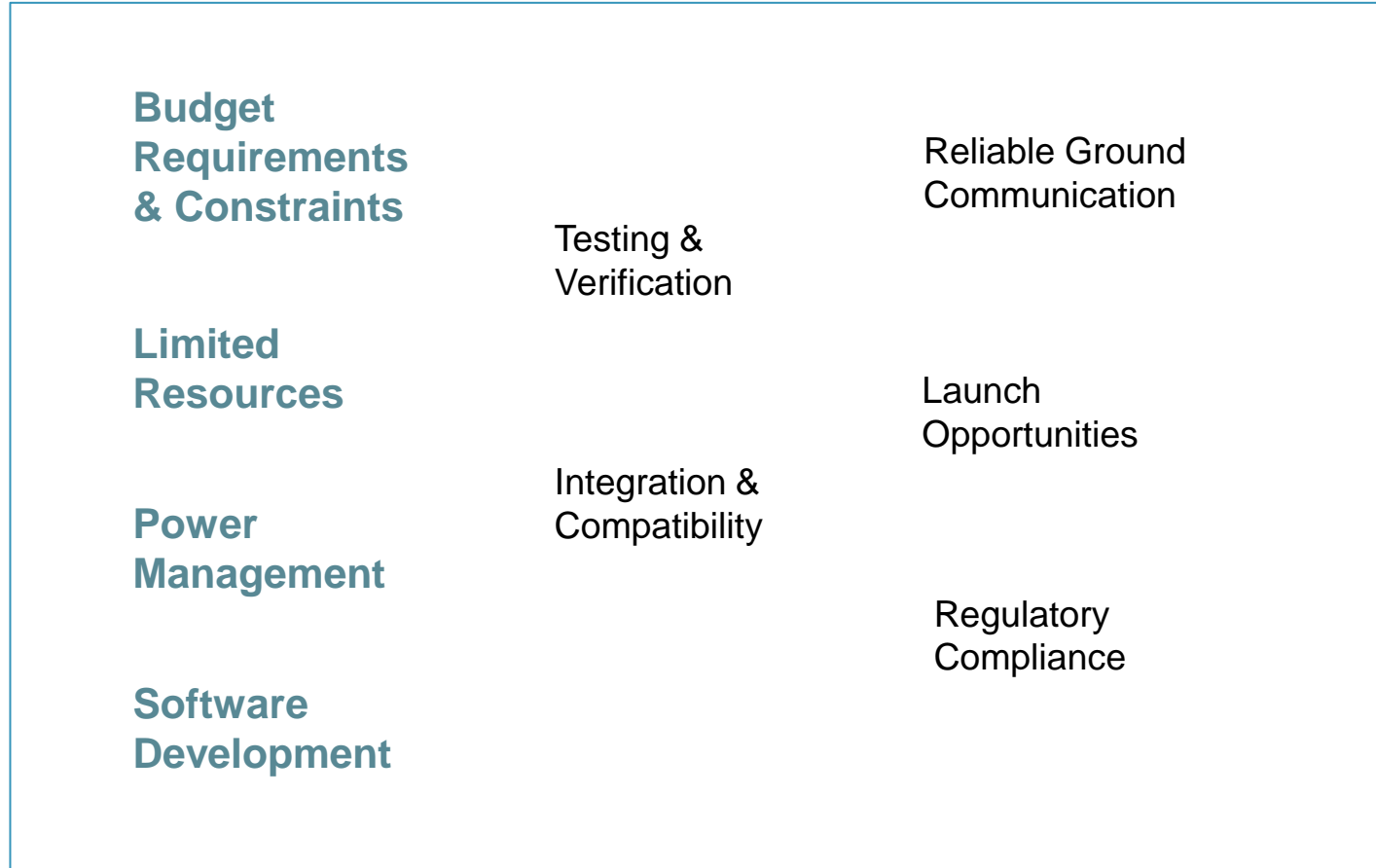


Operational Analysis



Common Challenges

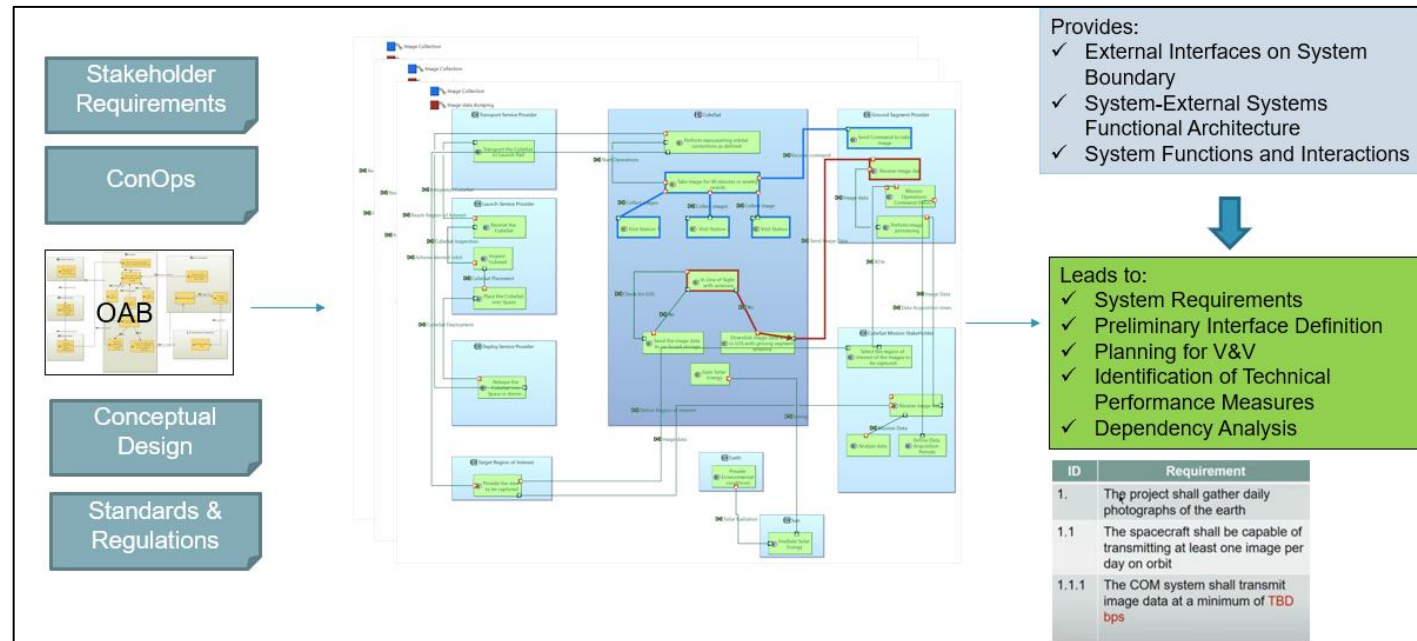
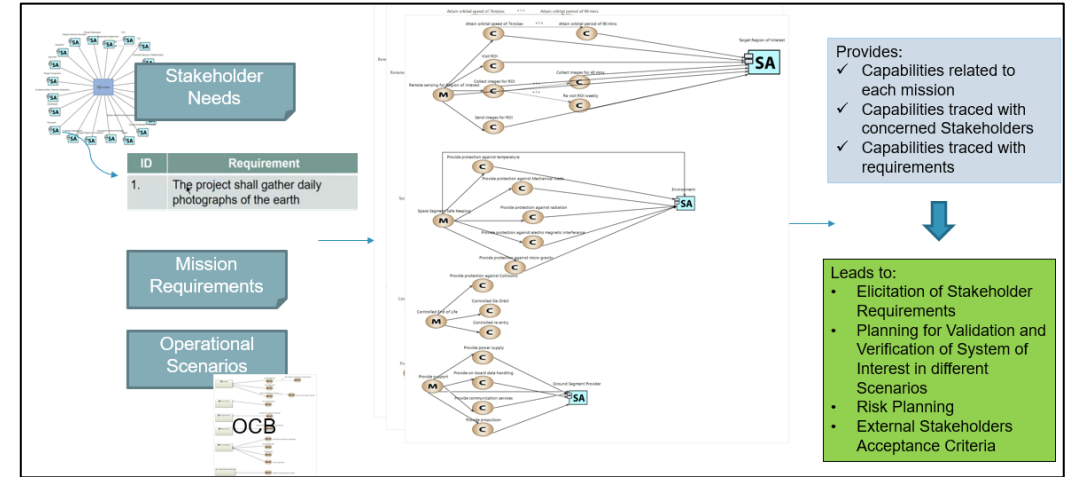
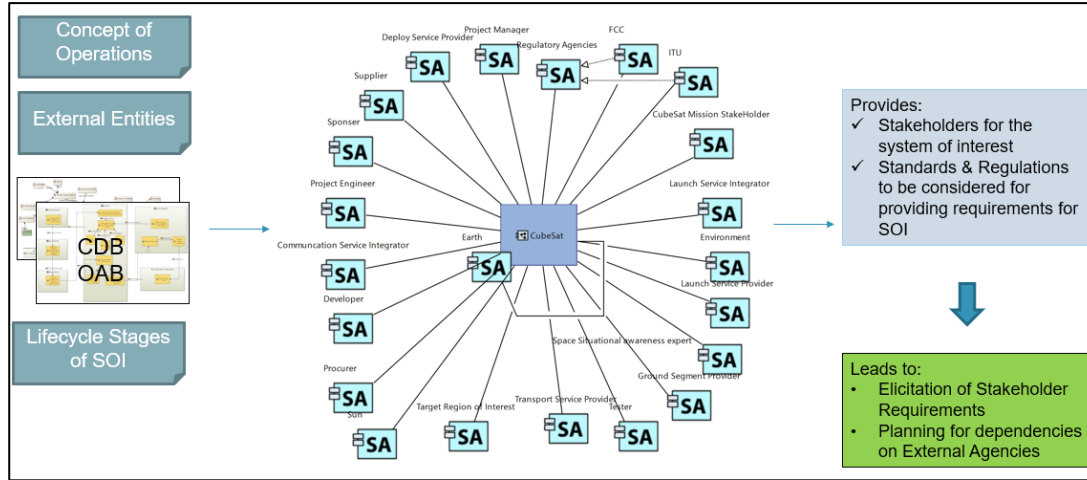
TECHNICAL CHALLENGES



MANAGEMENT CHALLENGES

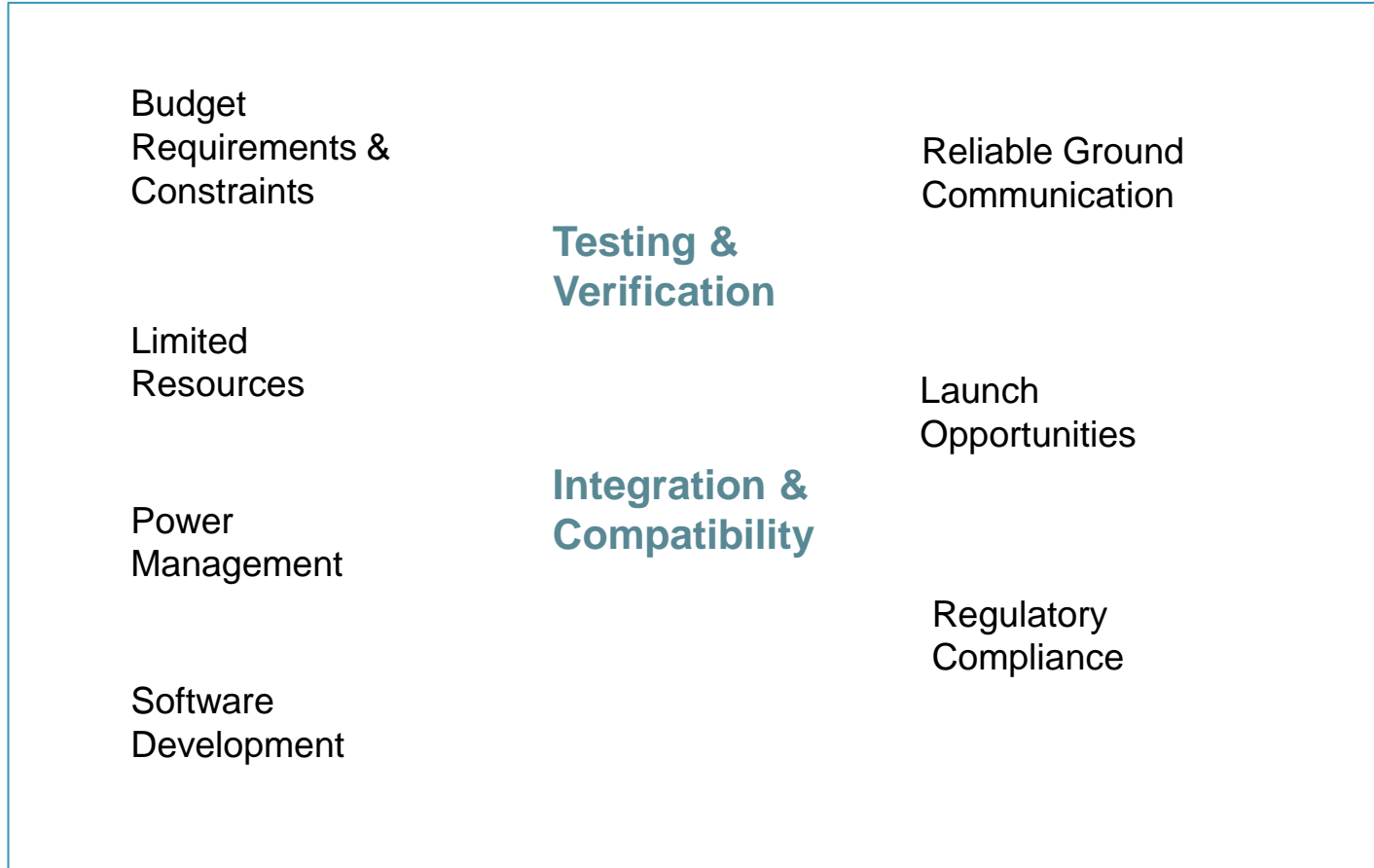


System Analysis



Common Challenges

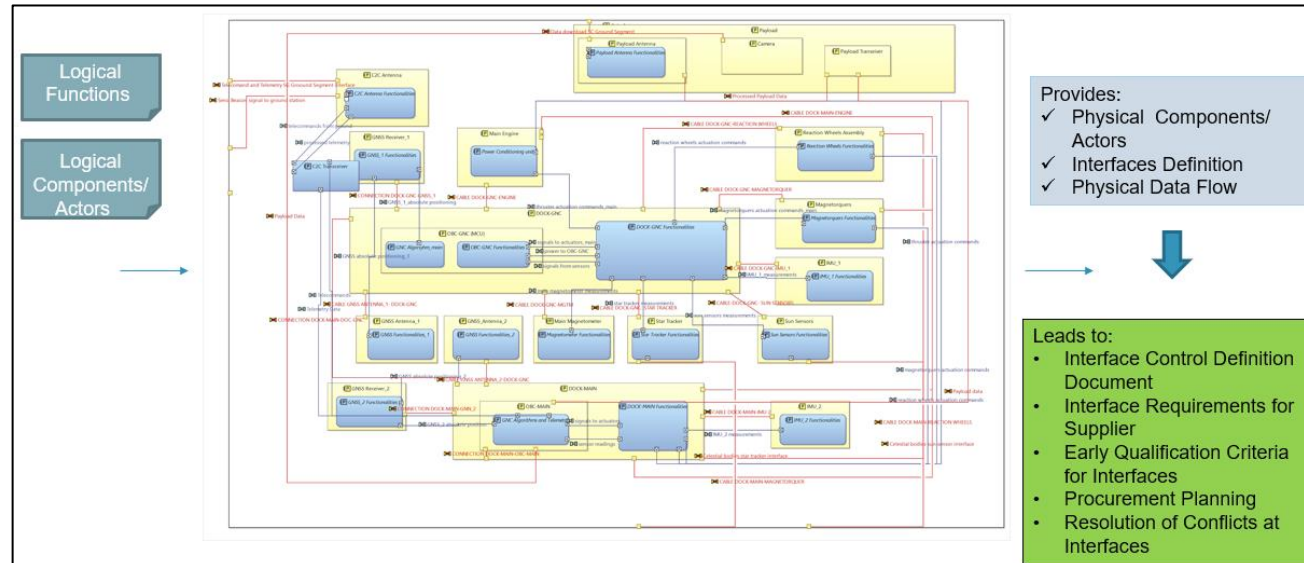
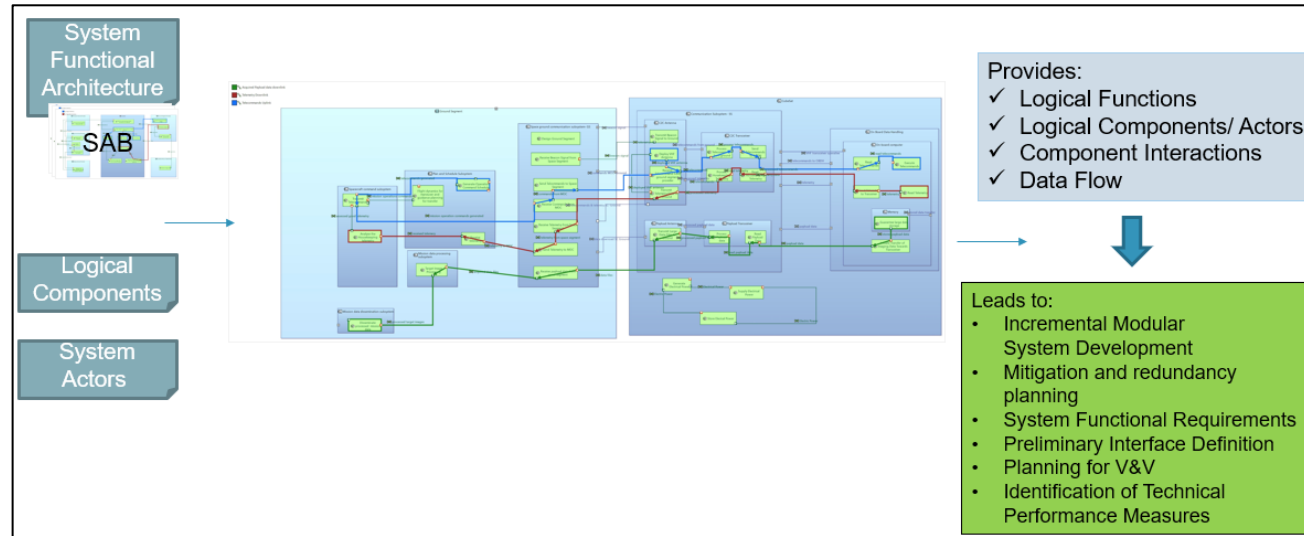
TECHNICAL CHALLENGES



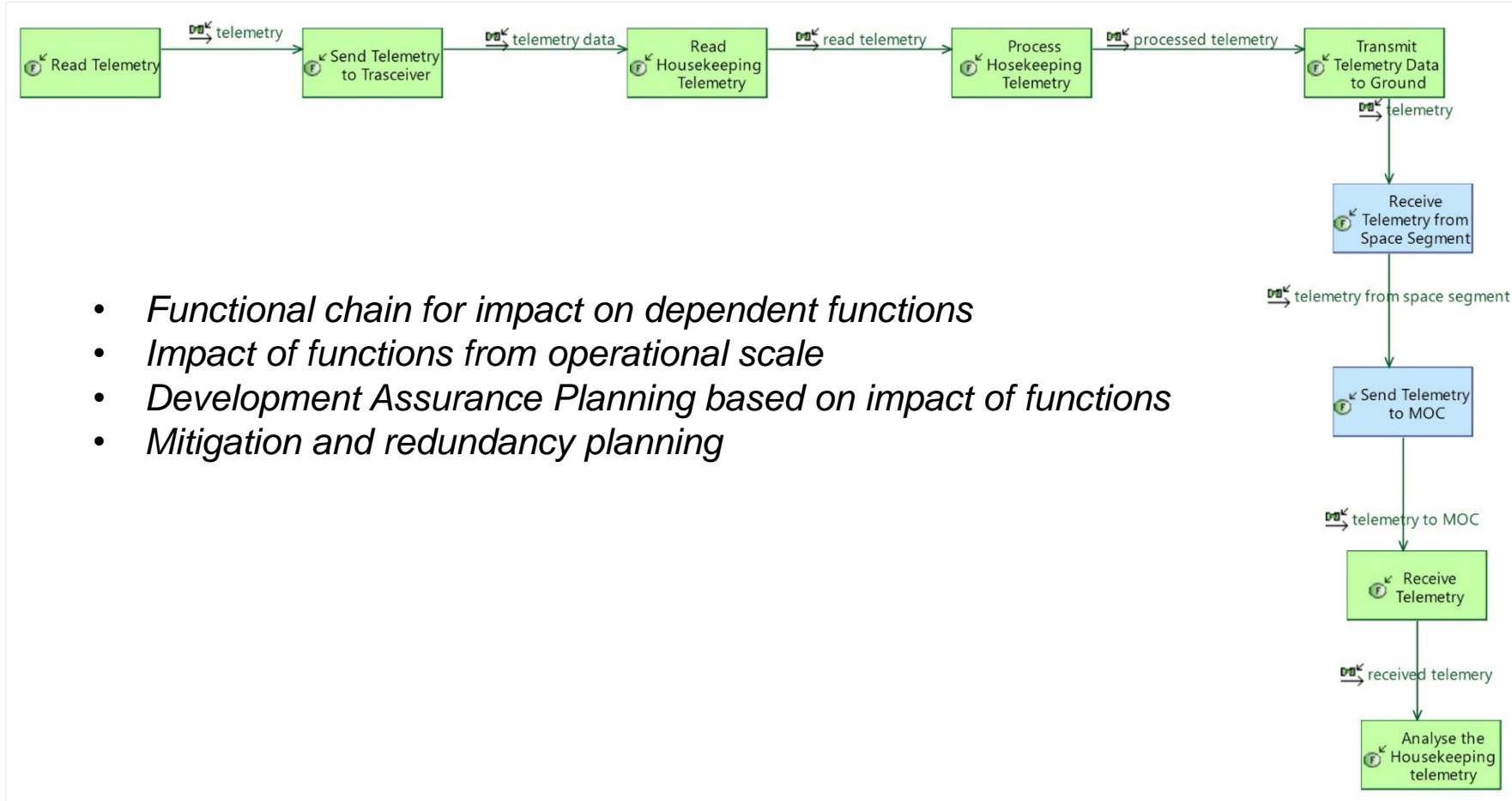
MANAGEMENT CHALLENGES



Architecture

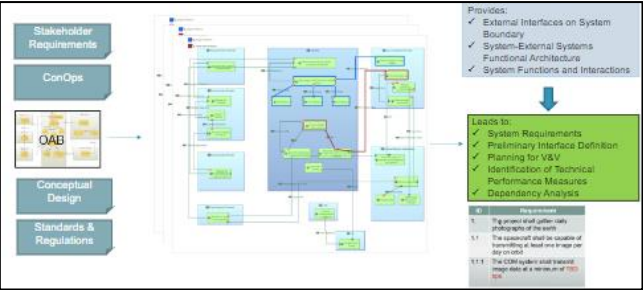


System Model- Observations

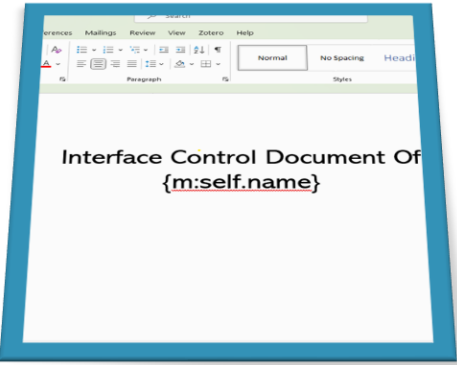


- *Functional chain for impact on dependent functions*
- *Impact of functions from operational scale*
- *Development Assurance Planning based on impact of functions*
- *Mitigation and redundancy planning*

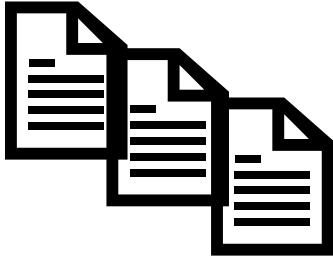
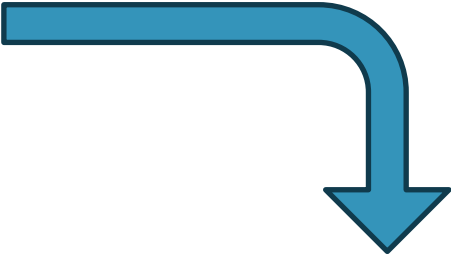
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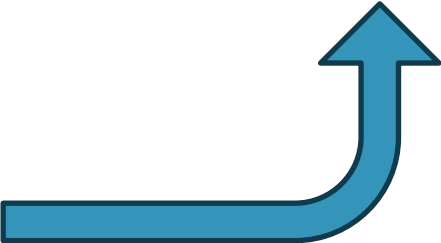
Model File



Template



Documents



Conclusion

- Modeling approach from mission operations objectives to initial architecture for analysis using Capella: Common challenges in CubeSat development identified.
- Observed added rigor and precision to SE activities as well as effective complexity management with the use of Capella's systematic methodology : Tailored SE process for CubeSat development.
- Up to date effective system models, could further enable knowledge sharing and consistent documentation while reducing the time and efforts invested when concluding project phases : Use of Capella models in conjunction with SE process.

Thank You