

CRAFT PROSPECT A Space Engineering Company

Lessons learned in applying MBSE to the development of autonomous and highly secure nanosatellites

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CAPABILITIES





- Trusted partners in
 - Mission delivery and
 - Subsystem development
- Core capabilities established in
 - Quantum technology & optics
 - Onboard intelligence
 - Mission & systems engineering
 - Embedded systems
 - Spacecraft operations
 - Model based systems







- Remote & cybersecure working
- Integration lab and workshop
- Thermal cycling and ESD shaker
- ISO7 cleanroom
- ISO5 laminar flow cabinets •
- Rapid prototyping 3D printing
- Dedicated AI simulation and Quantum optics test benches
- ISO9001 processes













- I. Usage of MBSE to develop the mission, payload and ground segment design of ROKS
- 2. Development of the service segment for Augmented Quantum Key Distribution Services
- 3. Investigation into assurance requirements for fire detection mission using onboard and ground Machine Learning









MBSE, Autonomy and the New Space Industry

- Usage of COTS components
 - Architectural visualisation is of higher value for design review and communication
- Design cycles are more rapid, requiring more frequent and faster document updates
 - More value in reducing document overhead
- Many more dependencies and constraints than larger spacecraft
 - Traceability aspect of MBSE is very useful to identify the impact of changes
- Increase in decision making points and complex functional architecture
 - Complex CONOPS which is significantly harder to manage in a document approach









- Overhead associated with selecting and learning the MBSE tools
 - How do you know what tool to use?!
 - Adaption to the language and development process used within MBSE
 - Correct modelling
- Adoption of MBSE by non-systems engineering disciplines
 - Managed by a systems engineer, must be for review by project stakeholders, other engineering disciplines
 - Hesitancy to use the MBSE model but instead rely on outdated documentation or verbal information
- Information Communication
 - Communicating the key information in the MBSE model to non-technical project stakeholders



Model Based Systems Engineering tools

S ENTERPRISE ARCHITECT

Pros

- Layered views in one location from system architecture down to component design
- Requirements management
- Auto Document generation
- Requirements document generation Cons
- Costs money (!)
- Limited number of users which increases overhead on systems engineers

Ideally suited for detailed system & sub-system design

More freedom = higher risk

📑 Capella

Pros

- Clearer architectural visualization
- Open source
- Exportable models
- Model multiple use cases/scenarios in one architecture diagram
- Enforces a development process
 Cons
- Limited requirements management management tools
- Less flexibility on approach

Ideally suited for high level mission & conceptual design Less freedom = Lower risk CRAFT

PROSPECT





- 1. Experimentally introduce MBSE into the organisation alongside traditional methods initially, although this may have a larger overhead than committing to MBSE outright.
- 2. Experiment with the views and analysis that work for particular design phases and stakeholder communication. Generate model templates and 'rules' to reduce the overhead when re-using models, starting a new project or preparing for a review.
- **3**. Account for the overhead of learning a new tool or invest in professional training.
- 4. In general, MBSE is a significantly better way to identify behavioural or functional architectures and interactions.
- 5. A combination of tools or frameworks could be used on a single project or within an organization based on the type of project or analysis that should be performed.



Spend more time on defining the methodology or process rather than tool selection.







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- Ensure the MBSE model is the system architecture blueprint across multiple engineering disciplines
- Detail an MBSE model through to test procedures and verification management
- Move towards executable system architecture models
- Integration within embedded system implementation







THANK YOU



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