



Delta-V Robotics

**SAT-PASS Tool for System Engineering to
Digital prototyping to Digital Twin.**

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Current Situation of Small Satellite

Small Satellite Industry is growing exponentially and these have various benefits such as low cost, agility, resilient, fast manufacturing, diverse range of people involved starting from Student to professionals etc.

But still Small Satellites are not used for crucial applications where chance of failure is unacceptable due to its high unreliability.

This hurdle can be solved by increasing the reliability





Mission

Delta-V Robotics (DVR) is a software technology company. We are building a platform targeted to very niche industry i.e. Small Satellite Industry.

DVR Mission is to increase the reliability of the Small Satellite Industry, so that these small satellite can be used to those mission where significant risk of failure is unacceptable .



How can reliability be increased

1. Follow the guidelines during designing and development of Satellite similar to what big satellite does, while maintaining the agility.
2. Learning from your previous missions
3. Model based design approach, during entire mission
4. Detail knowledge about every components and systems, while maintaining the time constraint
5. Enable mission operators with simplified information, that will help them to do operations, fault diagnosis, health monitoring and condition based maintenance.



SAT-PASS

DVR is building a cloud based AI platform named “SAT-PASS” which stands for Satellite Planning, Analysis, Selection and Simulation. The vision of these platform is to make satellite industry more accessible.

SAT-PASS aim is to increase the reliability of Small Satellite by making Model Based design adaptable and help easy transition to Digital Twin. Our core objective is to make software which is intuitive i.e. “easy to start with” while managing all the complexity.



SAT-PASS

SAT-PASS comprises of three Modules

1. System Engineering (SE) Management
2. Digital Prototyping/ Simulation
3. Digital Twin



Digital Twin

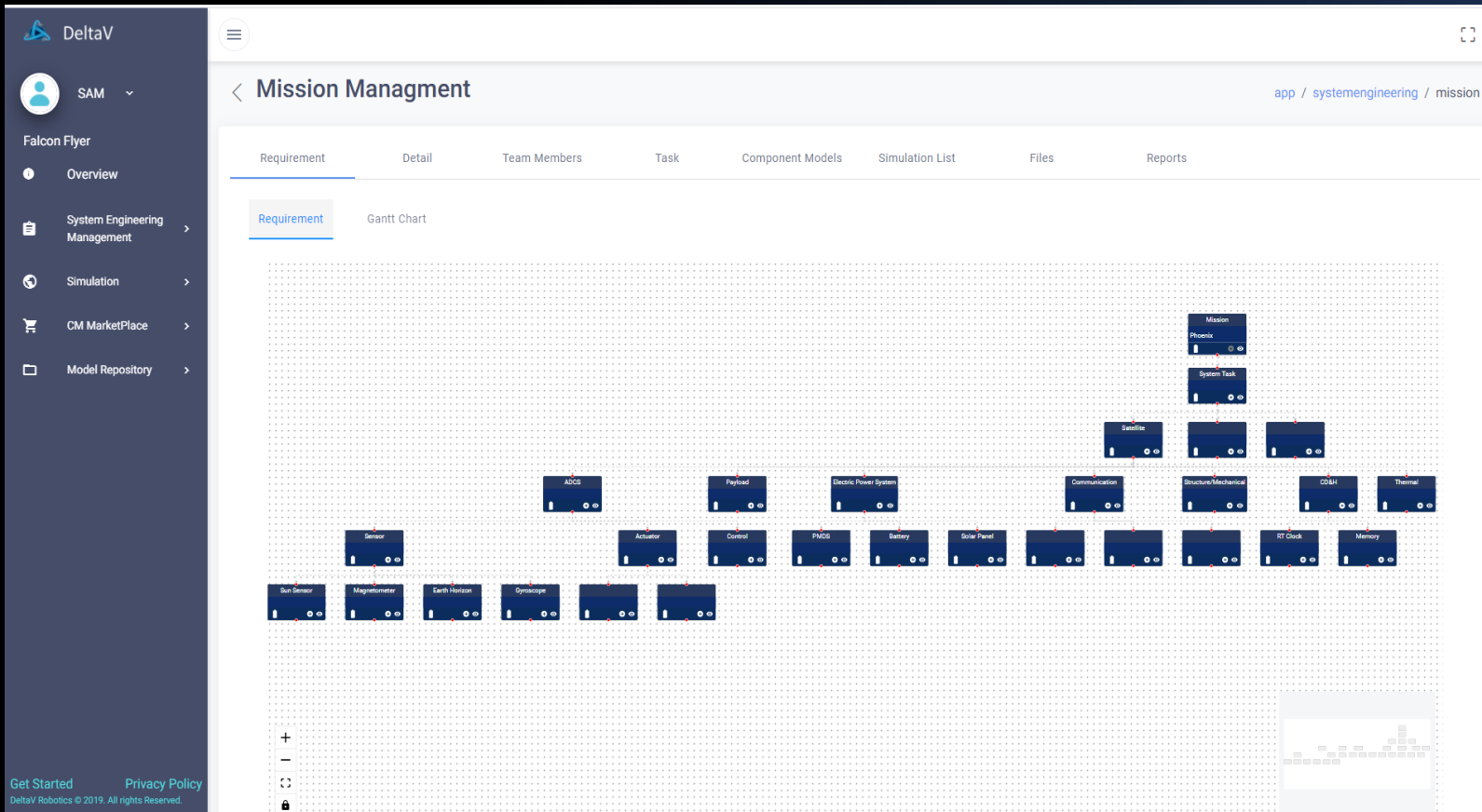
Gartner defines a digital twin as “a dynamic software model of a physical thing or system that relies on sensor data to understand its state, respond to changes, improve operations and add value, (representing) a combination of metadata (e.g., classification, composition, and structure) condition or state (e.g., location and temperature), event data, and analytics.”

Creating the digital twin is journey from System Engineering to Digital prototyping and simulation.



System Engineering Management

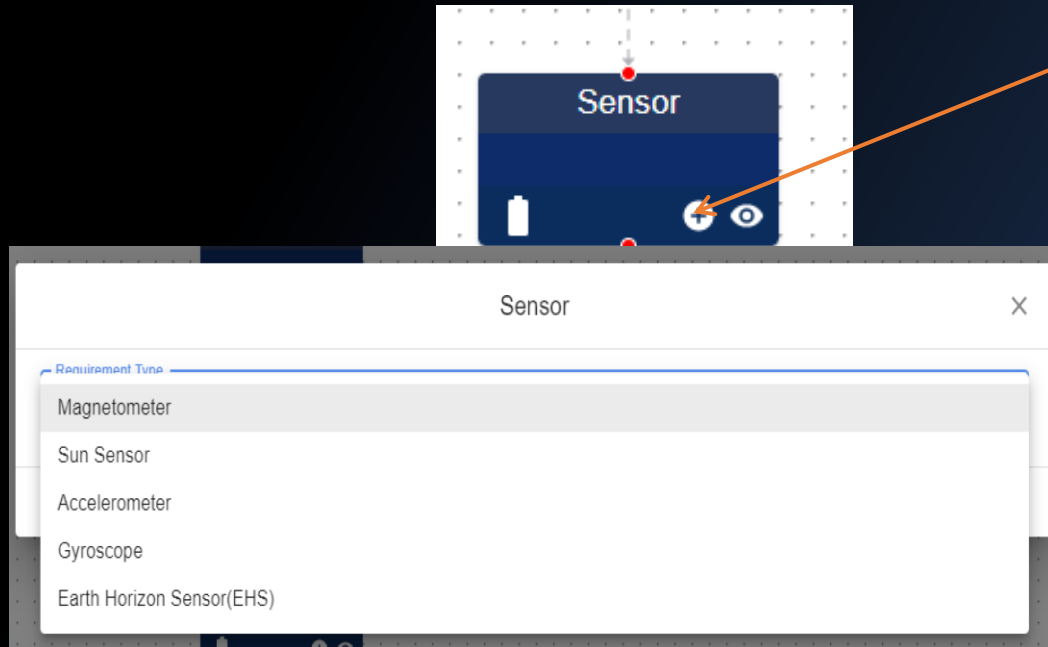
- SAT-PASS takes “Top to Down approach” by breaking the high level requirement into smaller requirements using 3 methods i.e. flow down , allocation and derivation.
- The requirement is displayed in a hierarchical pattern for easy and quick readability .
- SAT-PASS helps in concurrent designing , since members from different domain can come in one-platform and can contribute and data is flowing smoothly between each components.



SAT-PASS maintains the version of your each and every requirements, which shows the journey of the mission requirement.



SEM- Managing the requirement per subsystem/component/parts

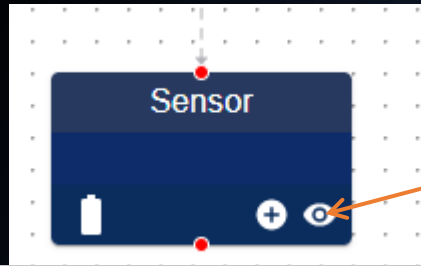


To add sub-module click on plus icon.

A pop-up will appear, with the list of sub-components based on parent node, basically every stage is predefined and well guided to help user to start quickly.



SEM- Requirement Traceability and verification



To add functional, operational requirement, click on the Eye icon.

The Requirements and its verification is connected with the Simulation.

Verification checks run in the background when parameters updates. If verification fails, an auto error report is generated.

This keep requirements and models in synch and this also helps to detect the impact of cross-domain like change in mechanical properties impact on ADCS.

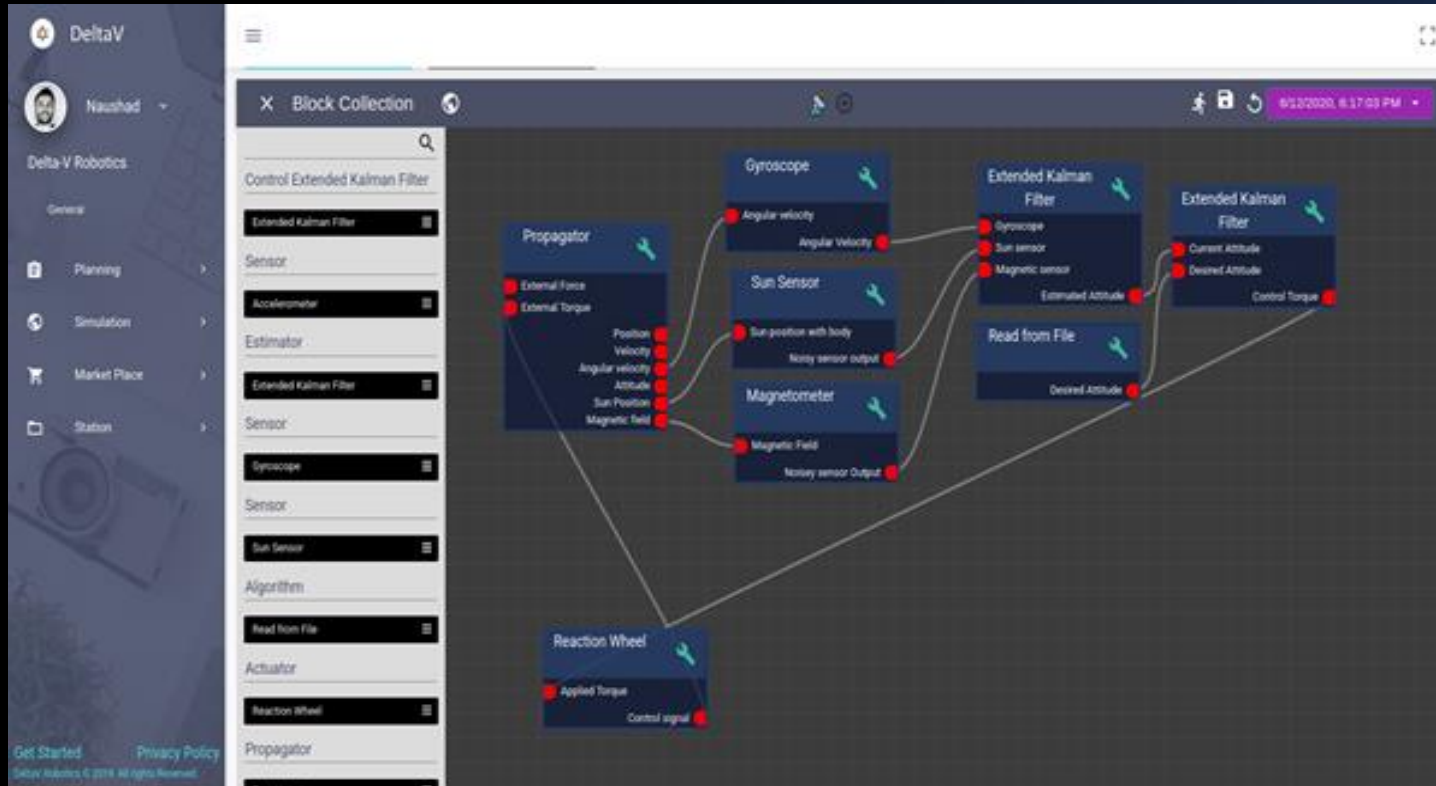
Req ID	Requirement	Equality symbol	Value	unit	Verification Type	Verification description	Analysis Method	Edit/Delete
Com-Ope-01	Sun Track Error	<	15	degree	Simulation	use SAT-PASS to run pointing error and calculate error	RMSerror	



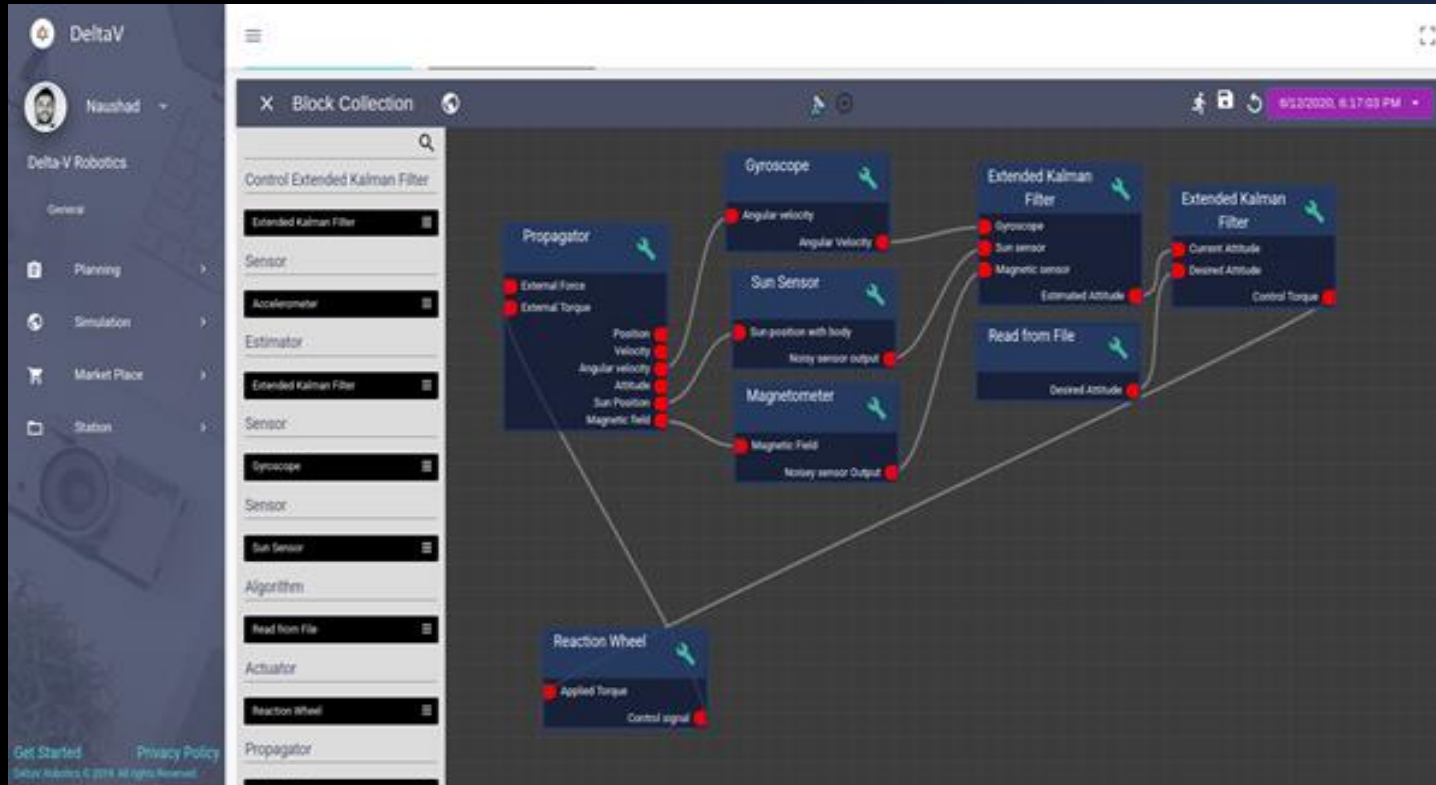
Digital Prototyping and Simulation

SAT-PASS provide the workspace where user can add satellite's subsystem, control and estimator algorithms, and connect them to create the satellite's digital prototype.

SAT-PASS has prebuilt Models of the satellite's subsystem, control, and estimator algorithm, which helps users kick start the mission in zero time.



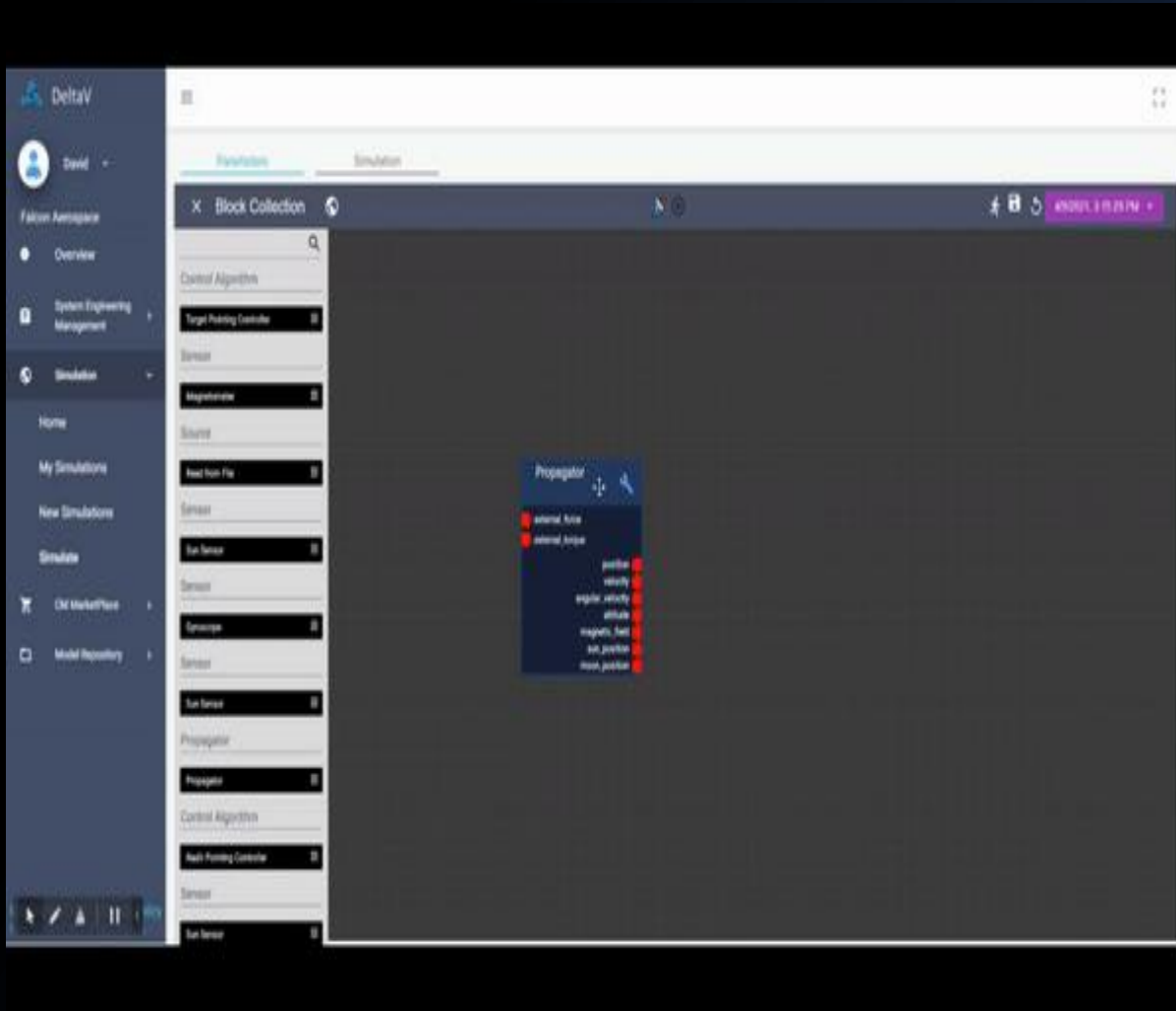
Digital Prototyping and Simulation



- ✓ The requirements added in SEM flows automatically here, for simulations.
- ✓ Simulation can be done for Satellite, orbit and its environment, Subsystems and its components. Visualization can be done both in 3D and 2D
- ✓ User can perform various analysis power budget analysis, Mission optimization etc.
- ✓ SAT-PASS help you in Software in Loop Testing.



Digital Prototyping and Simulation



- Drag and Drop blocks for configuring . Make usability very intuitive
- Flexibility to Add own Model in simulation .in various programming language such as C/C++/Python. User can write like stateful code.
- The connecting between blocks is also allowed ,if the input and output port can be joined have same unit, frames and size...
- The model should match the functional, operational requirements. Else error report will be generated. Keep the requirement component and simulation model in sync.



Digital Twin Flow

Digital twin is basically up-to-date digital representation of the satellite. If your satellite is degrading , Digital model will also degrade.

Application of Digital Twin

1. Can be use as Testbed during design phase.
2. Can be use for prediction maintenance , Fault Diagnosis and Health Monitoring.



How Digital Twin work

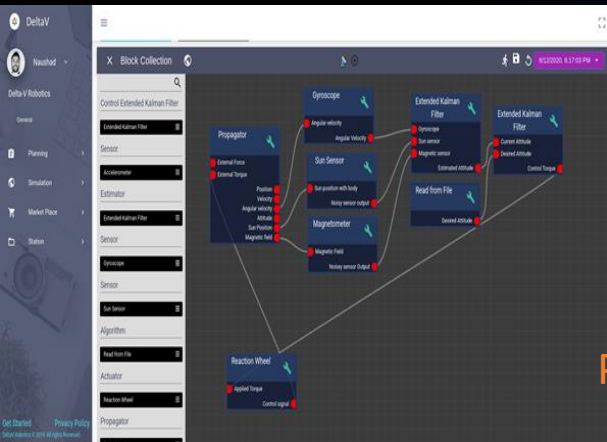
1. Satellite Digital prototype is required. User can use SAT-PASS to create digital prototype.

2. Telemetry data from satellite.

3. Digital Twin algorithm like prediction, fault diagnosis, etc which is inbuilt in SAT-PASS

4. Virtual model will provide, simulated data to digital twin's algorithm.

5. Digital Twin will provide the updated parameters to the virtual model



Simulated data
Updated Parameter

Digital Twin algorithms
Like prediction, fault diagnosis, etc

Satellite sate



Telemetry data



Key Takeaways

- ✓ SAT-PASS is dedicated to increase reliability of Small Satellite industry through its robust and smart platform.
- ✓ SEM helps to sticks with the guideline of design and development while maintaining the agility.
- ✓ SAT-PASS helps you to retain your assets such as models, documents in an organized manner.
- ✓ Digital twin of your previous mission gives a insights about your designing, manufacturing and operation process.
- ✓ SAT-PASS has strong adherence with “Model-Based Designed (MBD) ”. It helps the smooth implementation of MBD and effortless transition to Digital Twin.
- ✓ SAT-PASS digital prototyping modules helps you to do simulation quickly of various components and their impact on other component without even writing a single line of code. This helps you to have detailed information in a short period of time.
- ✓ Digital twin enable mission operators with predictive /prescriptive analysis and pre-defined strategies which provides important and helpful insights for operations.





Review

https://docs.google.com/forms/d/e/1FAIpQLSdb53Mx7VI6dnarwTVvJKxebnlfwVdfbv-QdxpoMSM1E9vfrw/viewform?usp=sf_link





Thanks !



Any questions?



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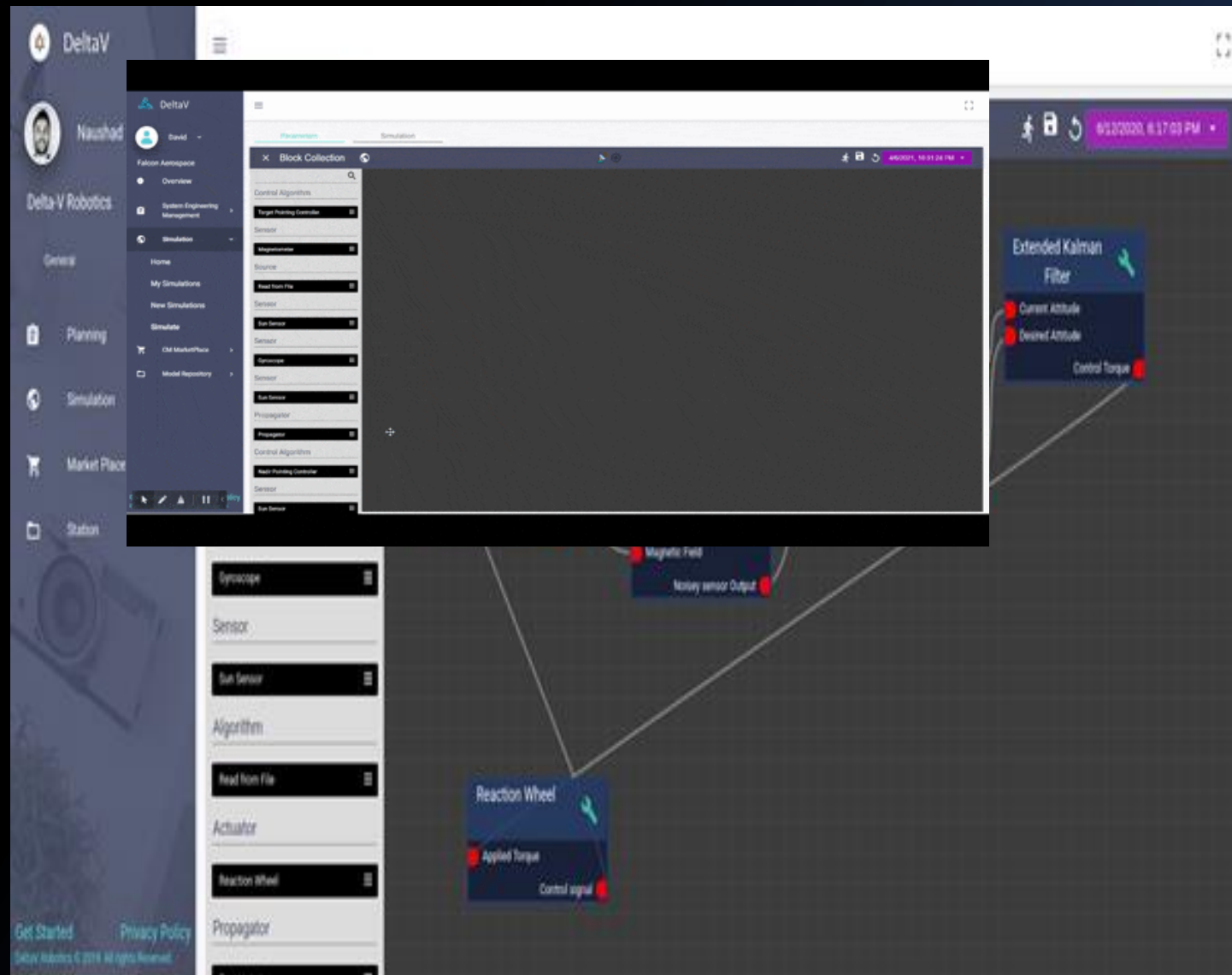


<https://www.linkedin.com/company/deltav-robotics/about/>



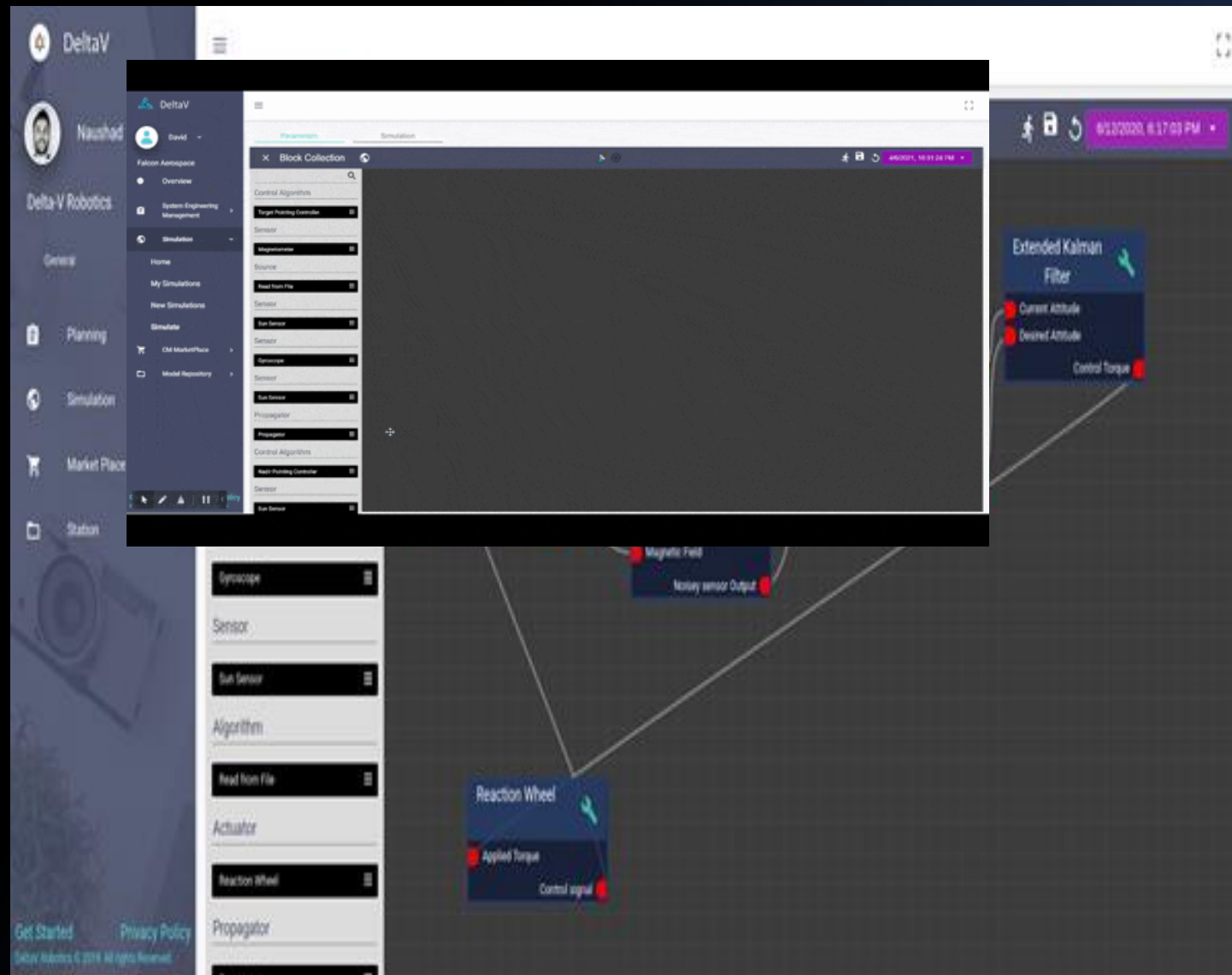
Digital Prototyping and Simulation

- Drag and Drop blocks for configuring .
- Pre-build Sensor Model , Actuator Model and Algorithms. Zero time to get start .
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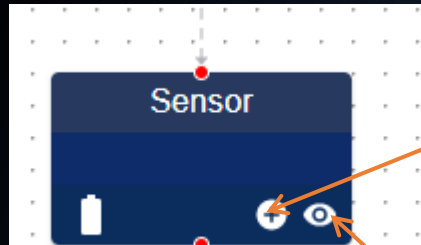


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Requirement Traceability and verification





To Add Sub-module click plus button.

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To validation is run every time when there is change in any parameters .

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Digital Twin Flow

