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Supporting Defence Aerospace development through advanced design systems simulation

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How can a focus on design systems simulation help defence aerospace companies?

- Delivers virtual systems simulation and evaluation capabilities for multi-physics based integrated systems.
- Supports modelling and simulation from earliest design stages through multiple levels of fidelity to final virtual prototype
- Delivers outputs that support decision-making through the entire development process
- Permits architecture trade-offs from design requirements through to performance validation and control calibration
- Allows early risk assessment at lower cost

Why might defence aerospace companies need to improve their design systems simulation capabilities?

New technologies, compliance, regulatory and sustainability challenges are emerging, particularly with the move to more intensive use of electrification within aircraft design.

The trend vastly increases product design complexity, very different from the complicated nature of former mechanical design. This complexity brings with it a huge increase in data and a need to manage the interaction of data sets.

To maintain model continuity, to secure and ensure data traceability and ease engineering collaboration, it is essential to have the tools required to de-risk these innovative, complex systems early in the design process and at lower cost.

With innovative propulsion systems involving hybrid engine configurations or new exotic aircraft concepts, engineers can no longer use legacy tools or experience to assess performance.

Future combat aircraft and air defence systems are expected to operate in novel ways such as more autonomy in advanced air mobility or, as with space launchers, re-usability is considered essential to decrease operational costs. With more control and advanced automation of systems, a better understanding of the dynamics of the systems is an essential ingredient to ensuring that power, for example, is delivered "on demand" by the aircraft or propulsion systems.

Who in the defence aerospace industry may benefit from improved design systems simulation?

With the revolution in new complex technologies in aircraft, spacecraft and engine design, systems simulation is now required across all engineering domains. For example, power, hydraulic, electrical and thermal management systems must be compatible and their software systems integrated to operate together effectively.

Design systems simulation technology also has the ability to democratise the aerospace industry, allowing new start-up companies to support innovative design, for example in the Advanced Air Mobility Market, where design and associated development costs need to be significantly reduced to meet aggressive pricing objectives.

How may design systems simulation help deliver improved project outcomes for those in the defence aerospace industry

Design Systems Simulation is able to manipulate, transform and integrate large volumes of heterogeneous data from different areas of the design programme.

This delivers a "shift left" that delivers earlier stage verification and validation and an increasing value proposition much earlier in the design process.

By leveraging Model Based Systems Engineering (MBSE) principles and technologies, Design Systems Simulation manages data from, for example, design, data sheets, experimental tests and other simulations to create a comprehensive holistic perspective of the system - a digital twin.

Design System Simulations help to address the complexity of smart, automated and electrified products by bringing together mechanics, electrics, electronics and controls to produce this digital twin through integrated and connected digital threads.

These system threads and their resultant data form lifecycles that can be adapted and revised at a faster pace, with greater rigour, and are intrinsically linked within the complete product lifecycle.

The digital thread means that, when systems simulation needs to be enriched for detailed design, other 3D CAE simulations can be used to enhance both the designs and their articulated workflows.

Design Systems Simulations can also be helpful when product architects need to compare candidates' architectures, to make decisions based on key performance indicators, to verify requirements or to ensure high level requirements are correctly cascaded down to more domain oriented technical requirements.

In addition, leveraging a methodology called the Virtual Integrated Aircraft, engineers now have the ability to complement and harmonise MBSE with the help of systems simulation.

What are some of the benefits defence aerospace companies might achieve through using design systems simulation?

- Dramatically reduce time spent in design rework
- Reduce time spent on detailed design
- Reduces the number of physical tests needed to support certification
- Reduces hydraulic prototype costs by a factor of 4
- Reduces fuel system design cycle by 1 year and integration by 9 months