

## Vortex Studio

### System Innovation in the loop

With product success increasingly reliant on innovation, a multidisciplinary system engineering approach is more important than ever. Performing in-the-loop system-level simulation and testing early in the design stage is key to enabling organisation-wide creativity and placing the user at the heart of your engineering process.

**Vortex Studio** brings mechatronic design ideas together in an interactive simulation and visualisation platform.

It allows engineers, product managers, clients and stakeholders to evaluate design ideas and share product experiences in an integrated and immersive 3D environment, shortening the development cycle and encouraging innovation.

**Discover how Vortex Studio helps you create better products.**



# Your key to greater innovation

## Client success



**Thales (XPI Simulation)** together with the UK Defence Science and Technology Laboratory use Vortex Studio for research simulation for armored vehicle driver training.

As mechatronic product complexity and control system sophistication increase, predicting system-level behaviour is more challenging. **Vortex Studio helps you create virtual prototypes** to test product functionality with smart control systems and operators in the loop.

### Beat Your Competitors to Market

Vortex Studio lets you perform system-level testing earlier in the engineering process, allowing you to explore more design concepts, identify issues and performance gaps and decrease the number of physical prototypes required.

### Create Exceptional Client Experiences

With an interactive Vortex Studio- powered virtual prototype, you can conduct operator-in-the-loop testing and implement user feedback into your initial design, resulting in innovative solutions that surpass client expectations.

### Get Control of the Risks

By enabling system-level testing in realistic simulated environments, Vortex Studio provides a safe way to validate designs and prevents the need to deploy costly physical prototypes in dangerous conditions.

## Enhance your engineering process with interactive real-time simulation

Vortex Studio boosts engineering creativity throughout the entire R&D cycle. It lets product managers and system engineers to test design concepts and support sales and marketing efforts with interactive simulators showcasing equipment capabilities in virtual environments. Below are just some of the ways Vortex Studio can upgrade your processes:

### Human-Factors Engineering

Gather meaningful user feedback and evaluate the impact of design ideas and smart control systems on operator productivity earlier in the development process. Vortex Studio enables early operator-in-the-loop testing, letting you test line of sight, control layout and more in engaging, accurately simulated environments.

### Operational Testing

From heavy lift planning to subsea robotics accessibility studies, Vortex Studio lets you reproduce working conditions and confirm your product's ability to complete critical objectives prior to deployment. You can recreate worksites and simulate interactions between your virtual prototype, equipment and environmental conditions, letting you identify issues that might prevent mission completion.

### Client Experience

Maximise operator competence with your product and offer a superior after-sales support experience with customised training simulators. Create immersive learning tools for engineers, technicians and operators using engineering simulations and Vortex Studio's integration of visual, audio and motion systems.

### System Level Validation

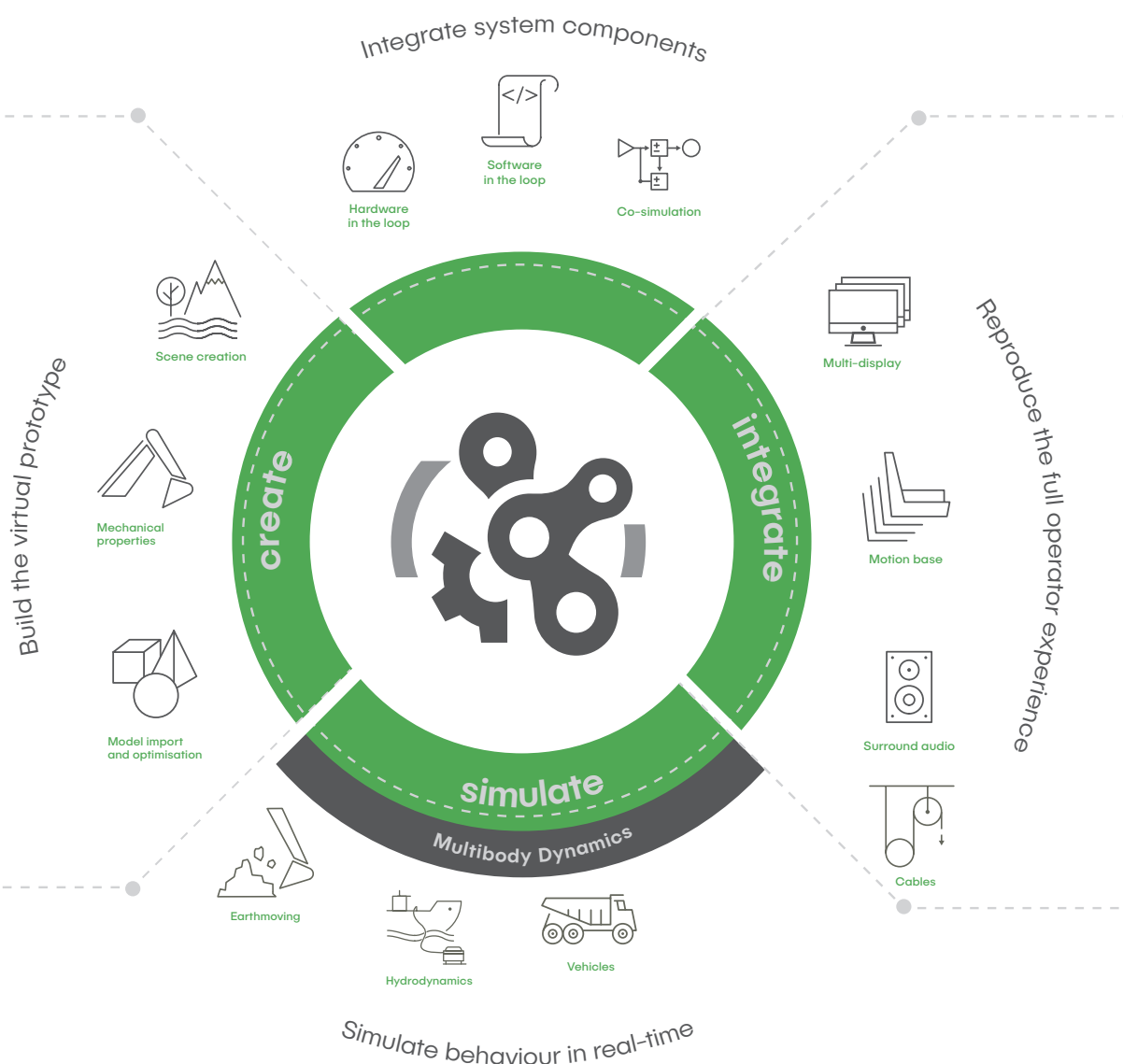
Compare design performance to requirements and visualise system behaviour in full motion with an integrated virtual prototype. Vortex Studio connects control systems, sensors and model-based simulation solutions into mechanical models, providing a 360o view of system capabilities and allowing you to evaluate emerging design behaviour in interactive environments.

# A complete multibody dynamics simulation and visualisation platform

Vortex Studio is a complete off-the-shelf simulation and visualisation platform. It covers the entire simulation process, from creation and integration to validation and deployment. With intuitive desktop editing tools, out-of-the-box integrations, validated simulation models and immersive visualisation capabilities, Vortex Studio reduces the effort required to create engineering-grade real-time complex machine simulations. Combined with CM Labs' training and support services, Vortex Studio lets you focus on creating innovative products.

**Trusted,  
proven,  
experienced**

Vortex Studio is trusted in space, on the worksite, on the battlefield and in the ocean depths. That is why NASA, John Deere, Volvo, Liebherr, Lockheed Martin, Subsea7, Oceaneering and many market leading organisations have selected Vortex Studio software to improve their products and processes. Vortex Studio is backed by an experienced team of simulation and engineering professionals. CM Labs provides a dedicated team of mechanical dynamics experts, engineers, and 3D software specialists—all focused on delivering the accuracy and flexibility you need to support your design projects. You are in good company. With 20 years of experience developing simulation solutions, we can help you maximise real-time simulation and visualisation technology in order to make informed and effective decisions. Vortex Studio is a mature commercial product that includes upgrades, documentation, and support — we know what it takes to prepare for the challenges ahead.





# Create

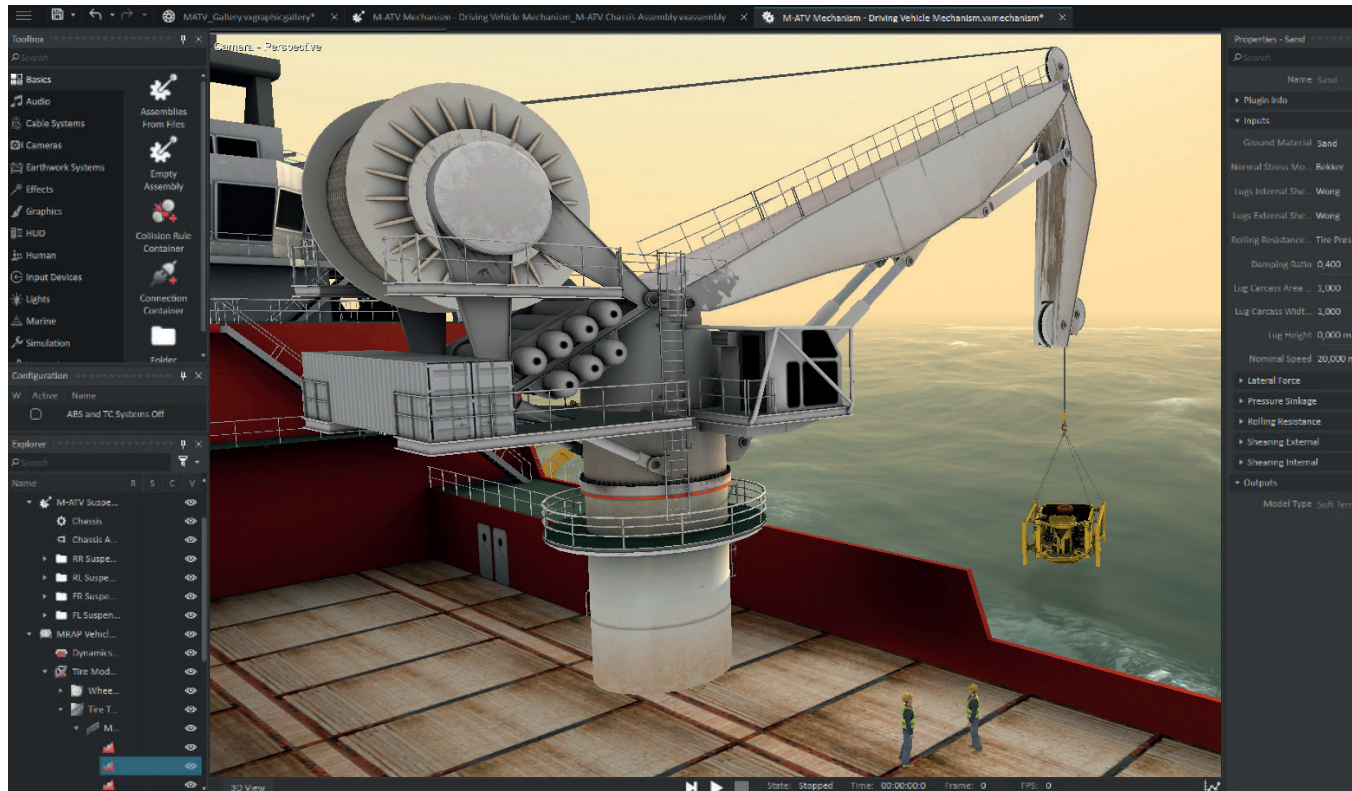
With its intuitive user interface and easy integration with engineering tools, the Vortex Studio Editor, the desktop-based 3D editing tool of the Vortex Studio, decreases the time and effort required to create interactive virtual prototypes and deploy them in realistic operating scenarios.

Built on years of experience creating rich, immersive simulations for training and engineering, the Editor's toolset empowers engineers and facilitates collaboration.

## Client success



Honda Research uses Vortex Studio to study motion models and grasping for the development of control algorithms for Asimo and other advanced robotics.



## Intuitive User Interface

The Editor was designed with ease of use in mind. It allows engineers to rapidly define a virtual prototype's mechanical and physical properties, integrate controls and troubleshoot simulation performance using point-and-click tools. With the Vortex Studio Editor, creating immersive high-fidelity simulations has never been easier.

## Built-in CAD Import

Vortex Studio provides an efficient and reusable content creation workflow and makes it easy to create functional real-time 3D models. Rapidly transform 3D CAD assets into interactive virtual prototypes with the Editor's CAD import and defeaturing tools. Game-quality graphics created using professional 3D modeling software can also be imported, allowing you to achieve maximal visual fidelity.

## Interactive Scene Creation

Whether your equipment operates in space, above or below the water, in a farm field or battlefield, the Editor provides the tools to accurately recreate operating conditions and test your virtual prototype. Additional modules provide access to subsea and ocean visualisation, human characters, and sky and weather effects as well as flora.

# Simulate

Vortex Studio lets you to evaluate your virtual prototype's performance in scenarios replicating both normal and unexpected operating conditions. Vortex Studio simulates machine dynamics and contact physics, allowing emergent system behaviour to be tested and providing a comprehensive view of the design performance.

Vortex Studio can be extended with dynamics and visualisation modules, making it possible to inspect your product's behaviour in precise worksite and environmental conditions, and validate its capacity to carry out specific operations ahead of deployment.



## Earthworks Systems

Create deformable terrain and earthmoving equipment, and simulate cutting, scooping, compression, compaction, erosion and flow based on soil material. Select from predefined clay, sand, loam and gravel materials.

## Cable Systems

Simulate realistic cable, chain and rope interactions and collision with other dynamic objects, including winches, pulleys, rings, tethers and more. Cables adjust to bends and distribute mass and forces realistically.

## Marine Systems

Simulate fluid buoyancy, drag, and added mass hydrodynamic effects on rigid bodies interacting with fluids. Recreate any topside or subsea scenario with control over ocean states and waves, and render realistic 3D water with rich dynamic reflections, wake and underwater effects.

## Vehicle Systems

Simulate tracked and wheeled vehicles' engine, transmission, suspension and steering components, as well as the interaction between terrain and tire or tracks. Includes pre-defined templates of cars, trucks, trailers and construction equipment models.

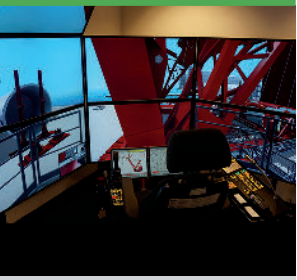
## Seeing is believing

Design teams need to innovate increasingly complex products that meet regulatory requirements in tight time frames. The key to innovation is systems engineering — a strategy that demands collaborative and simultaneous development of control software, mechanical systems, and anything else in between. System-level thinking begins with simulation and visualisation and real-time immersive simulation takes you a step further. It puts you in the driver's seat and lets you share the complete product experience with designers, management, and even the end-client. Product testing becomes an active part of the innovation process and accelerates design decisions. Vortex Studio allows design teams to bring together the physical product and its behaviour in the real world with system-level simulations of the equipment operating in a virtual world. This allows you to experience product usability in a blended virtual world with hardware and humans in the loop.



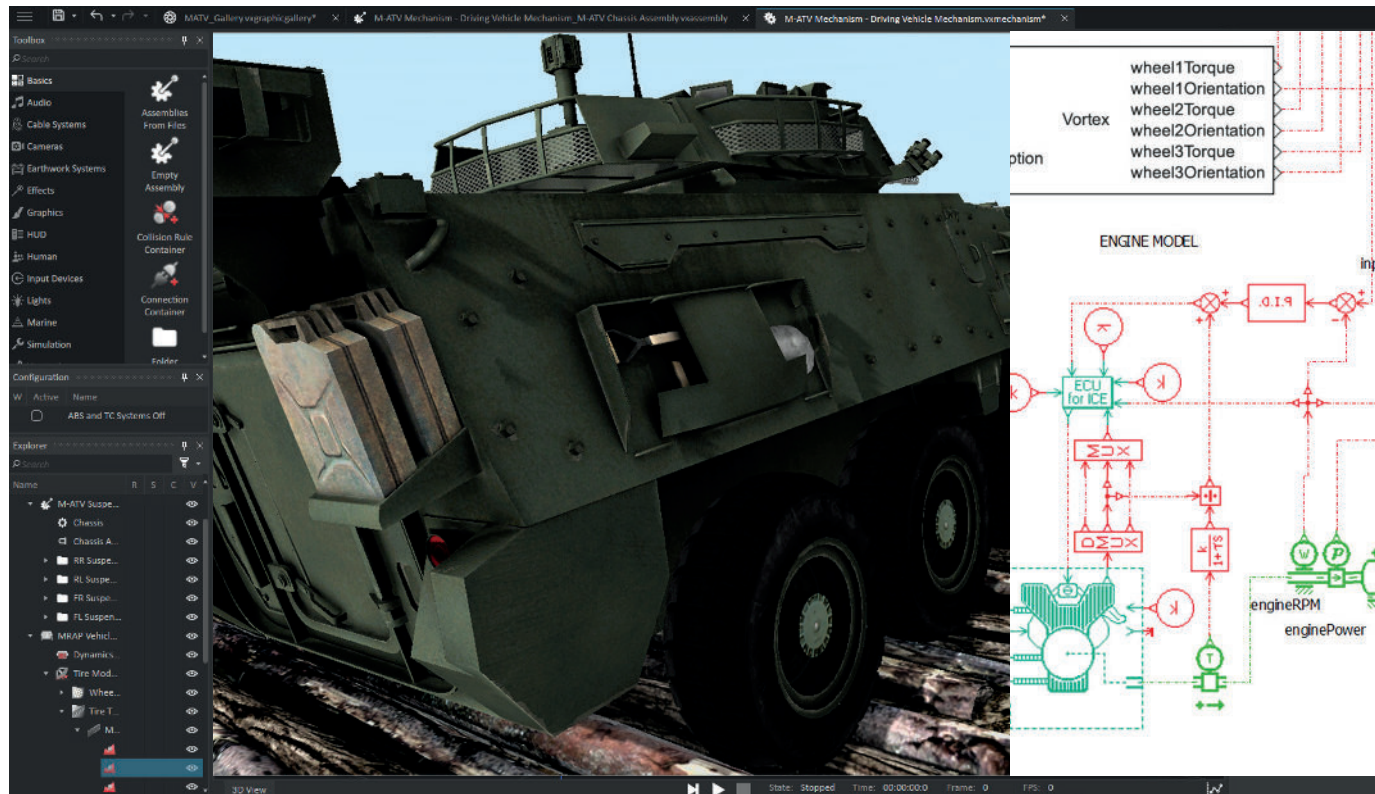
# Connect

## Client success



**Mammoet** created a simulator for its complex PTC 140/200 DS crane using Vortex Studio. The simulator integrates over 500 I/Os from 14 separate PLCs, and is also used to test control system software updates before deployment.

Real-time simulation makes it possible to place users in control of your virtual prototype, unlocking unique insights into how your design reacts to operator inputs. Vortex Studio Solution allows you to connect your virtual prototype with model-based simulation solutions, physical and logical control systems, and display and input devices. It lets you create an integrated virtual prototype and test each subsystem's interaction with the complete system in real time.



## Ready for In-the-Loop Testing

Vortex Studio simplifies hardware- and human-in-the-loop testing with easy integration of OPC server, CANBUS and USB devices. Create your own extensions to any external control system or HMI prototype with Vortex Studio's plugin architecture and simulate components such as cameras, motion sensors, GPS, and more to test control loops and system response to human operations.

## Perform Integrated System Validation with Co-simulation

Vortex Studio integrates third-party engineering simulation solutions and enables live co-simulation of existing hydraulic, electrical and mechanical models within your virtual prototype. Enhance simulation fidelity and extend your virtual prototype by integrating with solutions such as MathWorks Simulink™ or Siemens Amesim™ through the Vortex Studio distributed computing framework.

## Extend Your Simulation with the Vortex Studio SDK

Enrich Vortex Studio's built-in features, embed Vortex Studio in your application or connect to any software or hardware architecture using the Vortex Studio SDK. With APIs exposed through an embedded Python plugin, you can easily control your virtual prototype's behaviour and extend Vortex Studio functionality using custom constraints, GUI and more.



**SIEMENS**

# Immerse

Enhance the quality of operator-in-the-loop testing by creating an immersive visualisation environment that encourages test subjects to react naturally to simulated scenarios. Vortex Software Solution allows you to create an authentic user experience to perform a wide range of operator-in-the-loop tests and share findings and insights with clarity.



## Client success



**Allseas** selected Vortex Studio to create a virtual prototype of its massive heavy-lift and decommissioning vessel, the Pioneering Spirit, and integrate it with Simulink control models. Using Vortex Studio visualisation Allseas deployed a multi-channel immersive simulation with ship deck controls.

## Create Ideal Testing Conditions

Vortex Studio allows you to easily replicate the user's operating environment in great detail. It combines realistic visuals, multi-display visualisation, surround audio and motion to accurately simulate cabin visibility, heads-up displays and machine motion in a seamless, engaging experience that maximises operator immersion and ensures meaningful test results.

## Validate Performance in Hazardous Conditions

Measure the impact of environmental conditions and validate performance in hard-to-replicate scenarios, such as confined space or deep sea operations, without placing expensive equipment at risk. Vortex Studio also makes it easy to assess mobility, roll-over and the impact of payload on a variety of simulated terrain directly from your desktop.

## Seamlessly Share User Experiences

Encourage organisation-wide creativity and showcase your product's capabilities to stakeholders and potential clients with the Vortex Studio Player desktop application. Using VCR-like timeline navigation controls, bookmarking and 3D camera positioning, the player provides full simulation replay and allows you to replace complex charts with intuitive video content. Captivate your audience and share the product experience as never before.



## About CM Labs Simulations

**For over 20 years, CM Labs has provided dynamics-based simulation solutions and services to organisations around the world. With a long history in the real-time visual simulation and gaming industries, CM Labs produces feature-rich simulation capabilities that set the industry standard for interactive 3D dynamics and simulated mechanical equipment behaviour.**

The CM Labs team features experts with decades of experience and wide-ranging backgrounds in training, vehicle dynamics, heavy equipment, and robotics.

With proven experience ranging from deep-sea to space projects, engineers, scientists and computing professionals—many with PhDs and master's degrees—excel at all aspects of visual simulation, from initial concept and R&D, to integration, training, and beyond.

Through Vortex Studio, its flagship simulation software, CM Labs provides capabilities for training simulators, mission rehearsal, serious games, virtual prototyping, and testing.

Vortex Studio customers include Cassidian, CAE, Honda, Elbit Systems, L-3, Lockheed Martin, NASA, RUAG, and over 100 other leading organisations.



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