VFS Design Build Competition 2025/26

The Role of Drones in Wildfires

Table of Content

AVL at a Glance

AVL at a Glance

Engineering | Simulation | Testing

1948
Founded

29
Countries Represented

12,200
Employees Worldwide

11 %
Of Turnover Invested in Inhouse R&D

75+
Years of Experience

50+
Global Tech and Engineering Centers

67 %
Engineers and Scientists

2,300
Granted Patents in Force

AVL at a Glance
Aerospace and Aviation

The world's leading private mobility technology company for engineering, simulation and testing.

- Electrification
- Simulation and software
- AI and automation

20+
Years of Experience

5,700+
E-Mobility Experts

1000+
Executed Battery Projects

50+
Global Tech Centers

650+
Battery and Fuel Cell Engineers

AVL Aerospace and Aviation References / Collaborations

VERTICAL

blueflite®

UNISPHERE

APELEON

BATEMO
UNDERSTANDING BATTERIES

VF VOLTA FOUNDATION

AVL Aerospace and Aviation
Your Partner For Engineering, Simulation and Testing

Battery
Fuel Cell
ICE
E-Machine
Inverter

Electric System
Hybrid System
Cooling System

Operating Strategy
Controls

Digital Twin
Predictive
Maintenance

Simulation Ecosystem

AVL Simulation Software Ecosystem
For Engineers – by Engineers

AVL CRUISE™ M	Real-Time capable multi-physical **System Simulation** for vehicles and beyond.
AVL FIRE™ M	Highest fidelity **Application Focused 3D-CFD** (Computational Fluid Dynamics).
AVL EXCITE™	The most sophisticated **Multi-Body Mechanical Simulation** for Noise, Vibration Harshness.
PreonLab	**Disruptive Meshless CFD**. Less effort – more insights.
Model.CONNECT™	**Mastering Co-Simulation** of multiple models and different tools.
AVL CAMEO 5™	**Powerful Optimization and AI** workflow to exercise simulation models.
AVL CONCERTO 6™	Going Beyond Numbers - The **Intuitive Data Analysis Tool**.

AVL CRUISE™ M At a Glance

Real-time Capable System Simulation

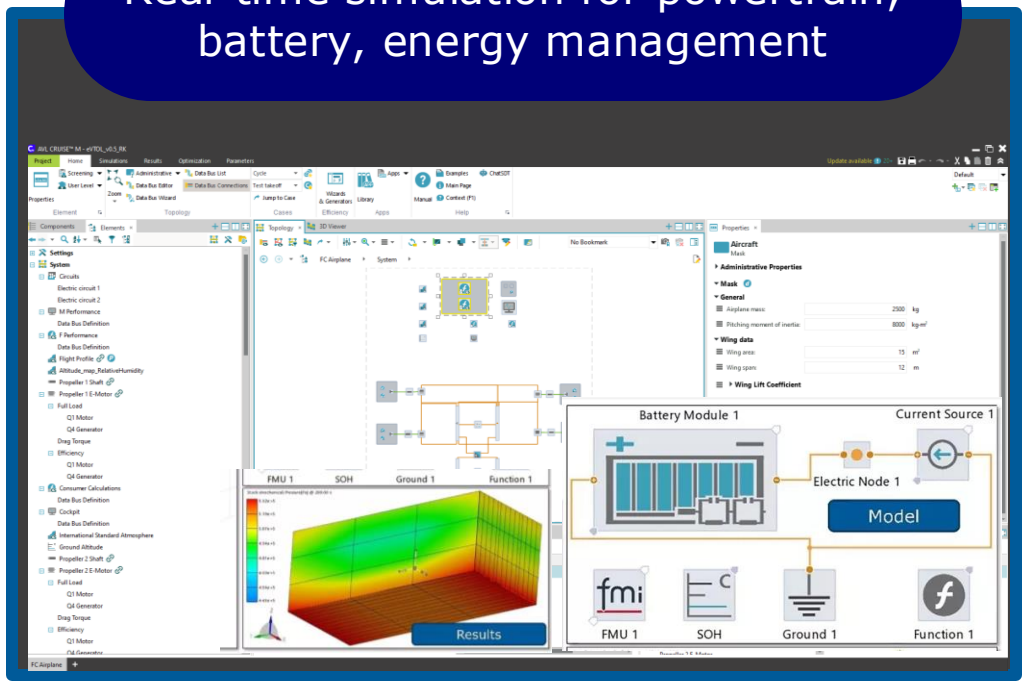
SIMULATION SPEED
Models ready for calibration of controls using virtual models in a Mil/HiL/SiL environment

PARAMETERIZATION WIZARDS
Created by engineers for engineers, industry proven workflows including FMI, Matlab and Python

MULTI-PHYSICS, MULTI-DOMAIN
Highly flexible for a wide range of fidelities and applications

VIRTUAL TWINS
Tailored to create virtual twins suitable for concept design up to control development

Real-time simulation for powertrain, battery, energy management



200+ Battery Cells
Battery FuelCell, E-Motor, ICE

Office and HiL

AVL CRUISE™ M
Aerospace and Aviation

How Can CRUISE M Apply To Vertical Flight?

Understand energy flows
of the system for the real flight mission (e.g. Sankey diagram)

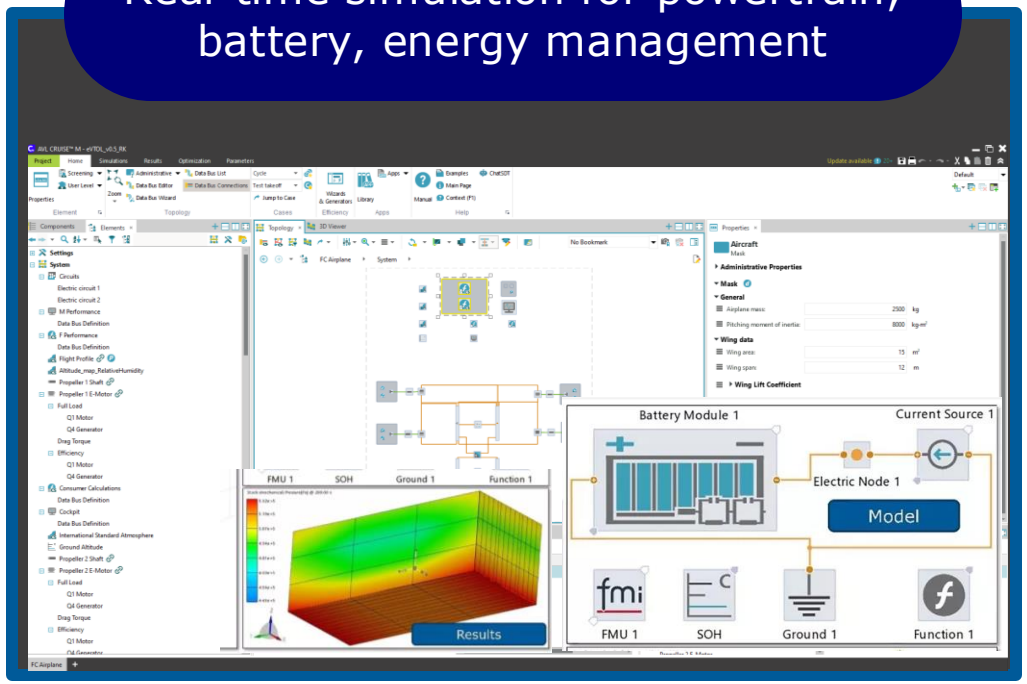
Know the real operating range
of the aircraft, and which routes it can serve

Explore the limits
of any electric system, from battery to ICE to fuel cells

Valid simulation models and reliable input data for development tasks or for more **accurate mission planning**

Virtually test failure modes
for safe and efficient control strategies with connection to virtual controls or hardware.

Real-time simulation for powertrain, battery, energy management



200+ Battery Cells
Battery, FuelCell, E-Motor, ICE

Office and HiL/SiL/MiL

FIRE™ M At a Glance

Highest Fidelity Application-Focused 3D-CFD

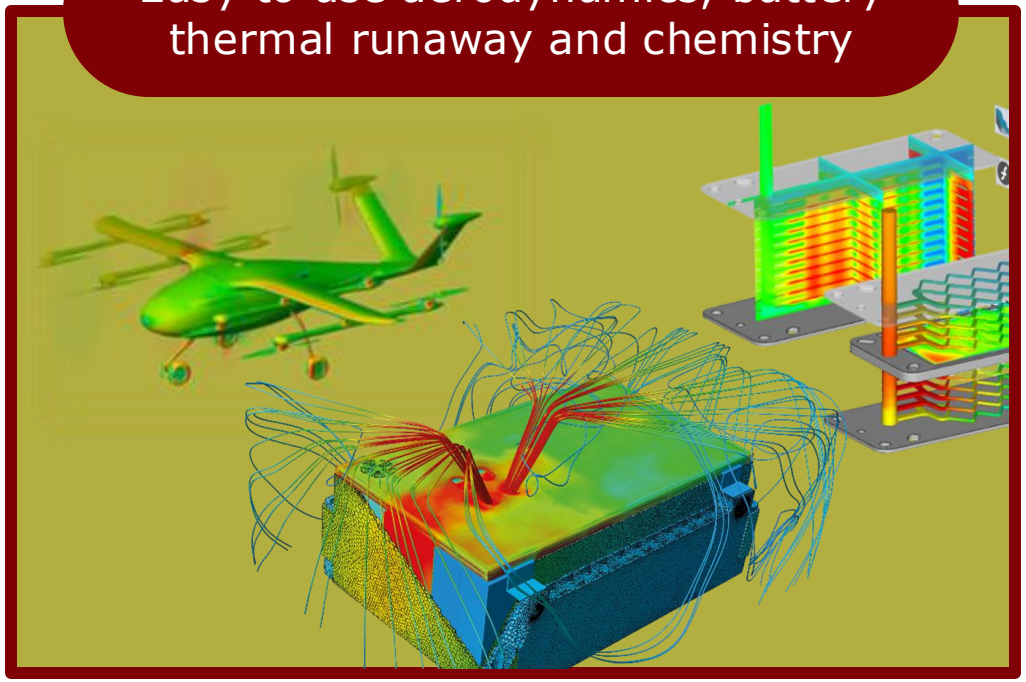
FOCUS ON CHEMISTRY
even suitable for the most complex Battery Thermal Runaway and Fuel Cell simulations

MAXIMUM USABILITY PERFORMANCE
Patented embedded body technology enables **aerodynamics for non-experts**

VALIDATED ACCURACY
Engineering proven in OEMs and Tier1s

WORKFLOWS
Guided APPs and python scripting for automation

Easy to use aerodynamics, battery thermal runaway and chemistry



Desktop Installation

Cloud-based Scalable Simulation

Multi OS

FIRE™ M
Aerospace and Aviation

How Can FIRE M Apply to Vertical Flight?

Easy retrieval of **drag and lift parameters** of the aircraft for system analysis.

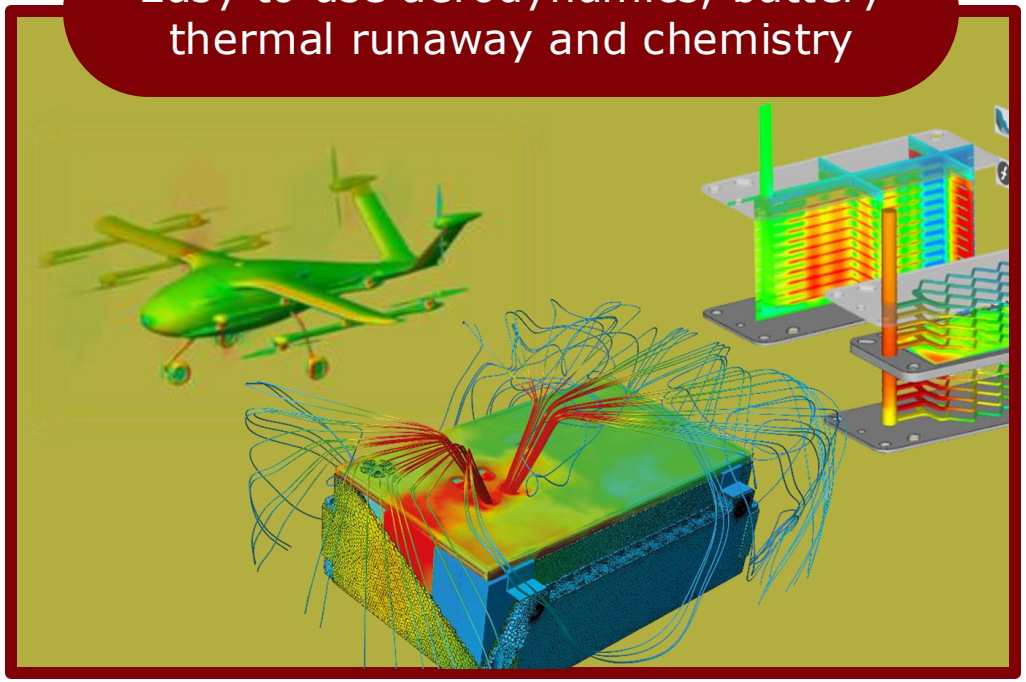
Assess safety measures to protect the system against external heat sources like wildfire.

Know the **real operating temperatures** of aircraft components like **battery and e-motor**.

Optimize the cooling design for safe operation in temperature critical environment.

Consider **wind conditions and rotor vortices** for a precise discharge of the extinguishing sand.

Easy to use aerodynamics, battery thermal runaway and chemistry



Desktop Installation

Cloud-based Scalable Simulation

Multi OS

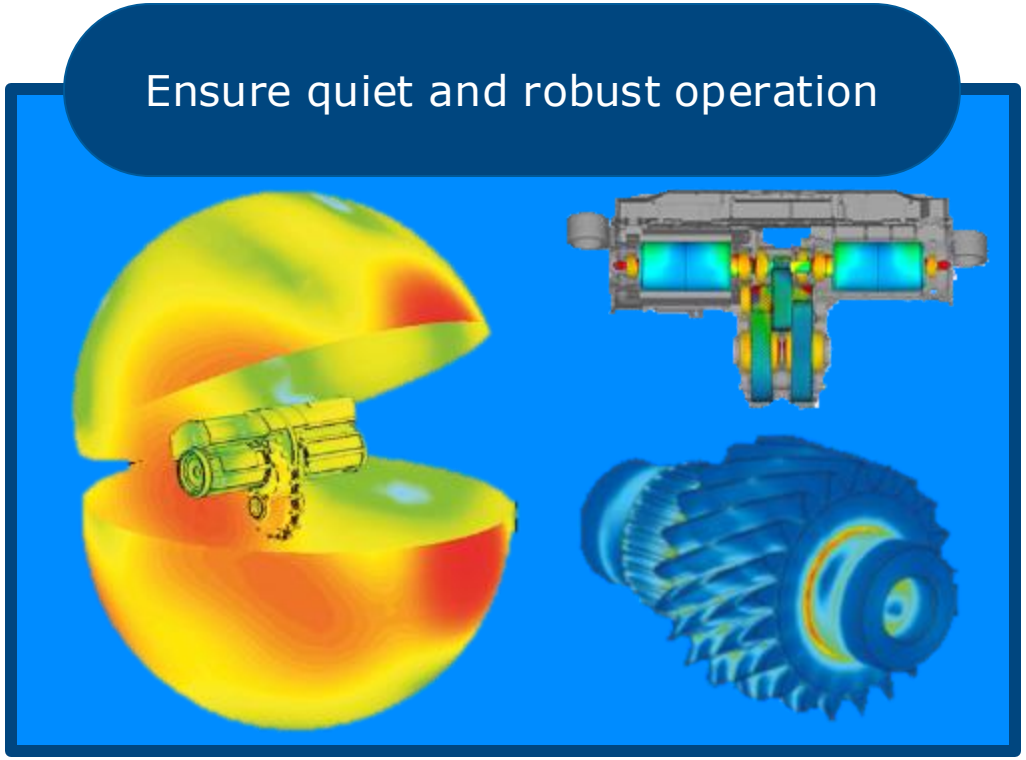
EXCITE™ At a Glance

Sophisticated Multi-Body Mechanical Simulation for Noise, Vibration and Harshness.

FIND CAUSES AND SOURCES OF EXCITATION AND VIBRATION.
using Operational Deflection Shape (ODS), Numerical Transfer Path Analysis (NTPA) and Modal Contribution Factors (MCF)

MAXIMUM ACCURACY
Time-domain simulations that capture non-linear effects and transient behavior. Virtual accelerometers to measure vibrations at specific points

WORKFLOW INTEGRATION
Consider production tolerances, and integration with CAD and electromagnetic simulations



25years
of technology leadership in NVH

100+ OEMs and TIERS
world-wide trust AVL EXCITE

EXCITE™ M
Aerospace and Aviation

How Can EXCITE M Apply to Vertical Flight?

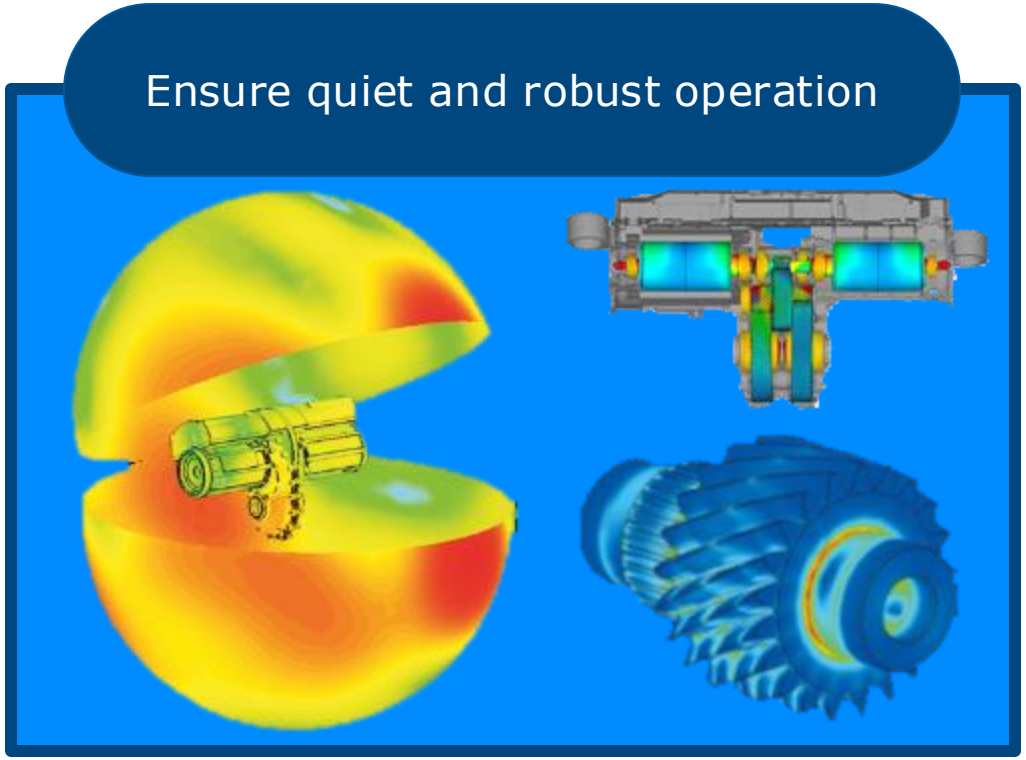
Rotordynamics & NVH
Simulate turbomachinery, e-motors, and gearboxes to ensure stability, vibration control, and low noise.

Durability & Fatigue
Predict service life of bearings, shafts, and gears under extreme loads.

Gearbox & Transmissions
Optimize efficiency, load distribution, and wear in high-speed aviation gearboxes.

Electrification
Support hybrid and electric aircraft by evaluating e-motor dynamics and thermal balance.

Noise & Comfort
Reduce cabin noise through vibro-acoustic path analysis, critical for eVTOL and urban air mobility.



25years | 100+ OEMs and TIERS

of technology leadership in NVH

world-wide trust AVL EXCITE

PreonLab At a Glance

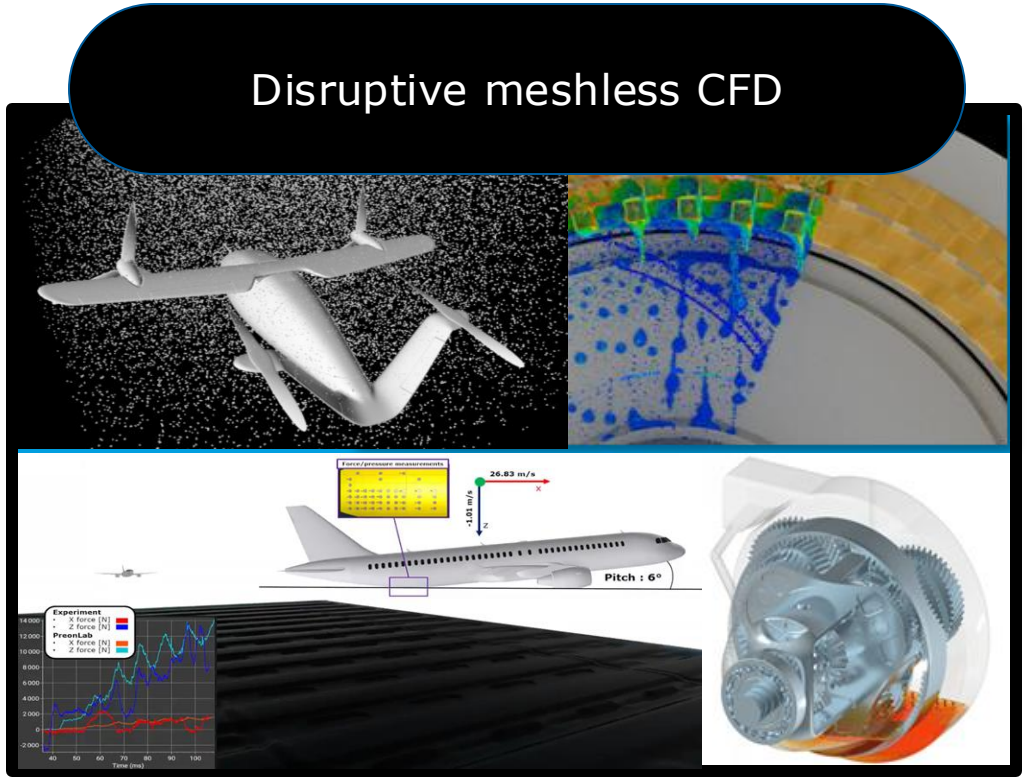
Particle-Based CFD Software For Rapid Prototyping

MESHLESS
Simulate rain, de-icing fluids, water tank sloshing, oil lubrication directly from CAD geometry

VISUALIZATION
Real-time in-situ visualization technology (developed in cooperation with DISNEY PIXAR) delivers clear insights

VALIDATED RELIABILITY
Proven for water ingress, water landing, soiling, gearbox lubrication and E-Motor cooling

USABILITY
Intuitive and easy to learn



100+
companies worldwide trust the industry leader in SPH

CPU GPU

Aerospace and Aviation

How Can PreonLab Apply to Vertical Flight?

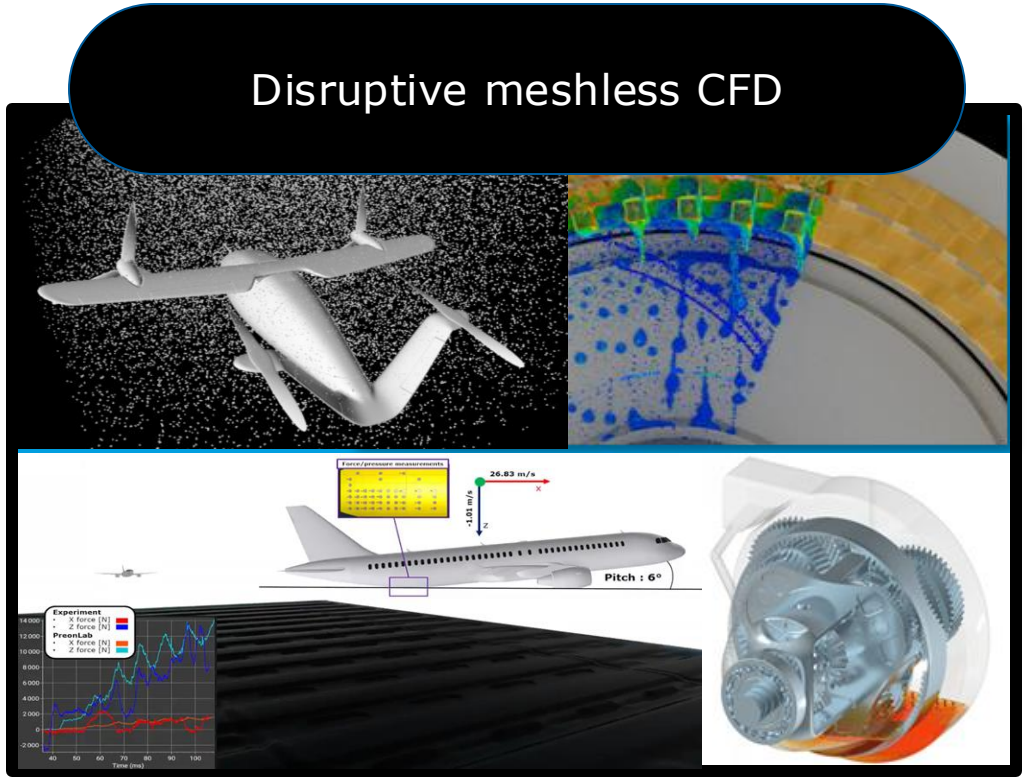
Achieve payload precision with real-time visualization of water spray trajectories and landing footprints, optimizing nozzle design, release height, and flight path under wind and rotor downwash.

Simulate **water tank sloshing forces** and assess their impact on drone stability and maneuverability during firefighting missions.

Rainwater management and water ingress simulation to evaluate resilience in harsh weather conditions.

Gearbox oil lubrication and e-motor cooling for endurance, efficiency, and system reliability.

Water landing simulation to study buoyancy, stability, and survivability in ditching events



100+

companies worldwide trust the industry leader in SPH

CPU GPU

Model.CONNECT™ At a Glance

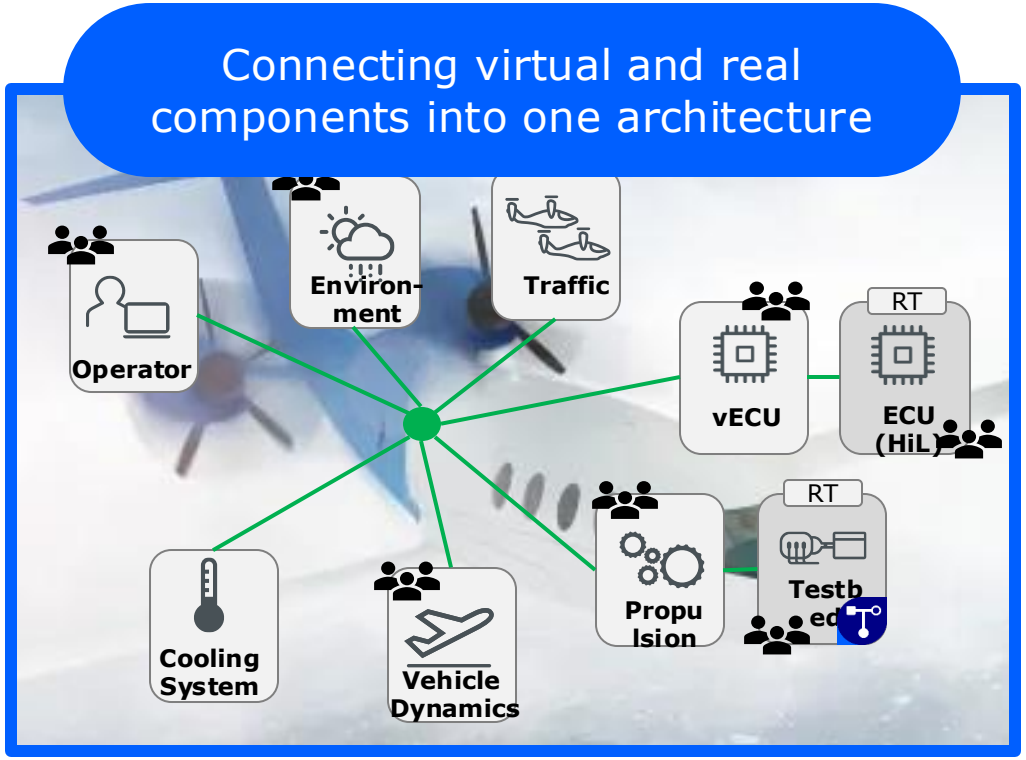
Enabling Collaboration & Integration Across Tools, Teams and Companies

SEAMLESS SWITCHING
between real hardware and simulation models

MAXIMUM PERFORMANCE
due to distributed computing

MAXIMUM ACCURACY
patented coupling error correction and patented technology for RT/non-RT co-simulation

OPTIMIZATION, CLOUD
as built-in framework support



30+ ready to use tools

and standard interfaces

Model.CONNECT™ Aerospace and Aviation

How can Model.CONNECT apply to Vertical Flight?

Link simulation models directly to testbench or in-flight data for real-time model updating and validation.

Bridge design and operation

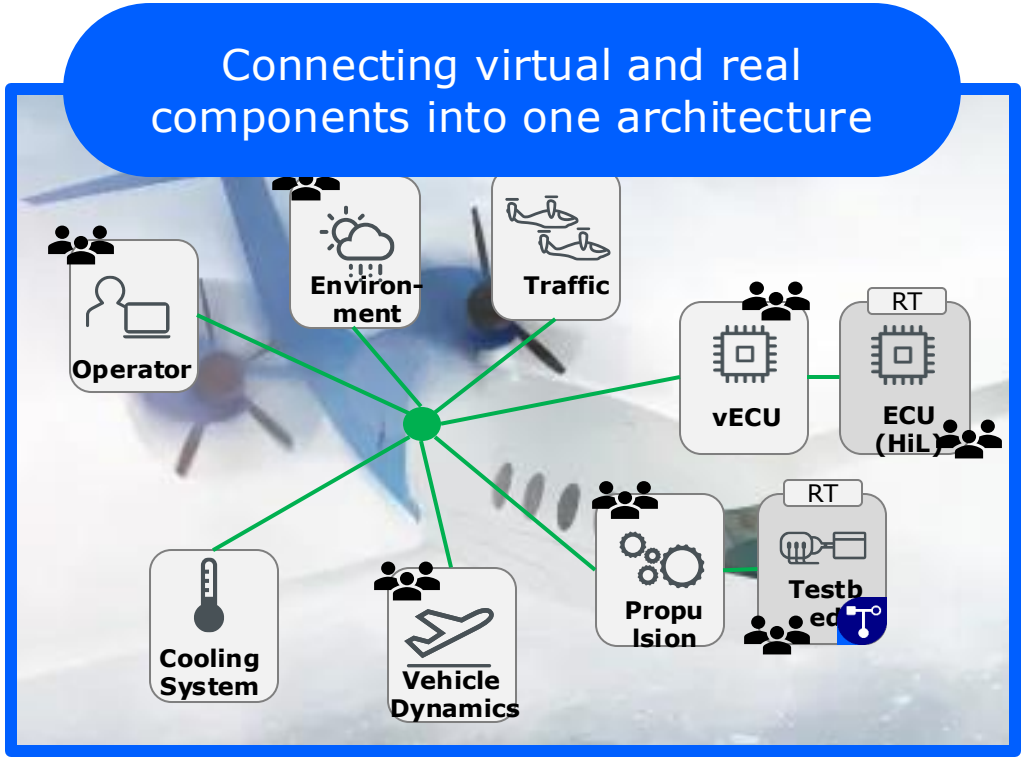
Same model supports concept, testing, and operational phases.

Neutral collaboration backbone

Aerospace teams often use various specialized tools. Model.CONNECT acts as a, allowing teams to work in their preferred environments while ensuring **consistent, synchronized simulation results**.

Enables **Software-in-the-Loop (SiL) and Hardware-in-the-Loop (HiL) setups** for avionics and control verification, by creating **one real-time co-simulation environment**.

Enables **traceable simulation workflows**, crucial for certification



30+ ready to use tools

and standard interfaces

AVL CAMEO 5™ At a Glance

The All-in-One Solution for Development, Calibration and Simulation Engineers

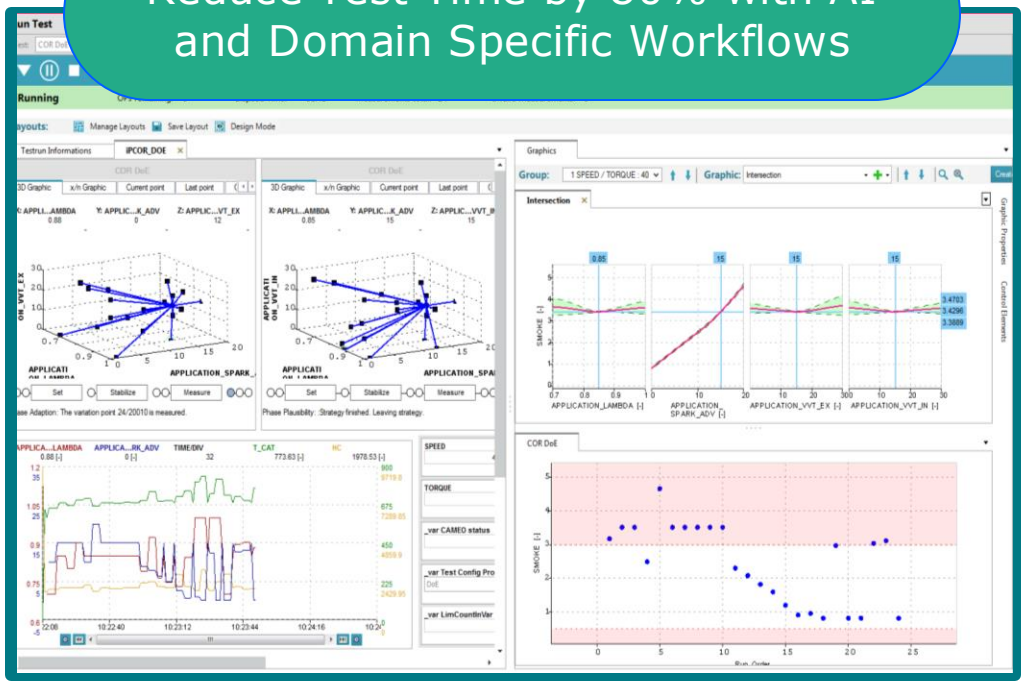
INTELLIGENT TESTING (REAL & VIRTUAL)
Safely & Efficiently, for all ICE / Hybrid / Hydrogen, Fuel Cells, E-Drive, Battery, Transmission, Emission and ADAS

CHARACTERIZATION
Understand Components and Systems.
Identify the best Trade-offs

OPTIMIZATION
Find robust Optima and minimize time with model-based optimization

AUTOMATIZATION
Real world and virtual tests, interfaces to 30+ testing and simulation platforms

Reduce Test Time by 80% with AI and Domain Specific Workflows



No code test creation | Guided advanced DoE setup

50+ built-in functions for easy test creation

AVL CAMEO 5™ Aerospace and Aviation

How Can CAMEO Apply to Vertical Flight?

Multidisciplinary Design Optimization
Balance weight, aerodynamics, propulsion, noise, and thermal limits across thousands of design variants..

Rotor & Propulsion System Optimization
Use DoE to refine blade geometry, motor efficiency, and gearbox performance for stable VTOL flight.

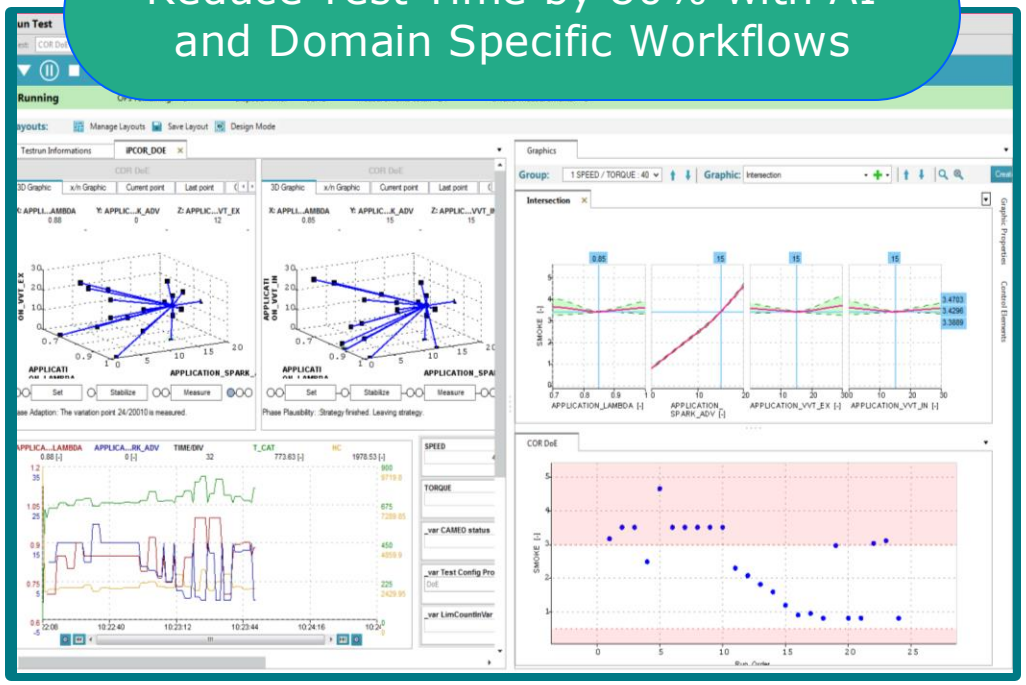
Energy Management & Mission Planning
Optimize battery sizing, cooling, and power distribution for hover, climb, and transition phases.

Control Strategy Tuning
Integrate with CRUISE™ M models for MiL/HiL/SiL flight control and automated calibration.

Reliability & Robustness Testing
Evaluate performance under wind gusts, payload shifts, and component wear.

Unattended Optimization
Select and run test points and adjust control parameters to optimize for any set of KPIs automatically.

Reduce Test Time by 80% with AI and Domain Specific Workflows



No code test creation | Guided advanced DoE setup

50+ built-in functions for easy test creation

AVL CONCERTO™ At a Glance

Going Beyond Numbers, The Intuitive Data Analysis Tool

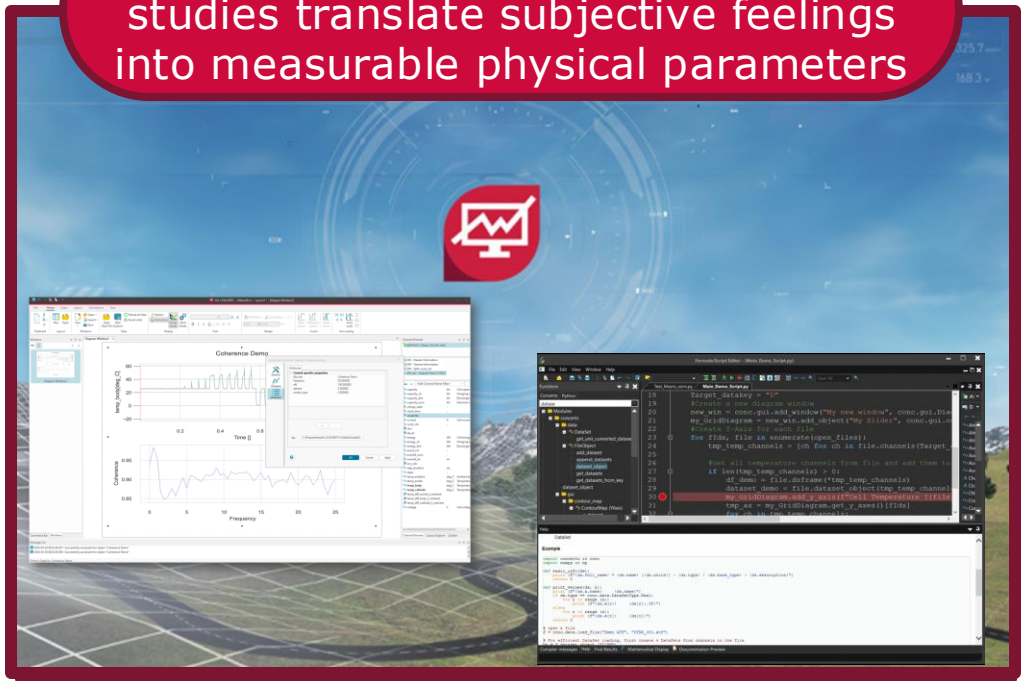
ENHANCED PROCESSING EFFICIENCY
Generate results faster, with features like automated data processing and Python integration.

ALL DATA FILES AT A GLANCE
Quickly process and analyze large datasets, supporting more than 50 different data formats

TARGETED ANALYSIS
Visualize and edit any kind of data in common views. Combine, convert and export data in one click

HIGHLY AUTOMATED PROCESSING
Fully automated and saleable data processing to get standardized results and reports

Algorithms derived from human studies translate subjective feelings into measurable physical parameters



Open for more than 50 different file formats and data sources

Dozen ways to visualize and interact with data, standardized and shareable.

AVL CONCERTO™ Aerospace and Aviation

How Can CONCERTO Apply to Vertical Flight?

Test & Simulation Data Management
Unify aero, thermal, and NVH simulations with test data (wind tunnel, battery, flight logs) into a single source.

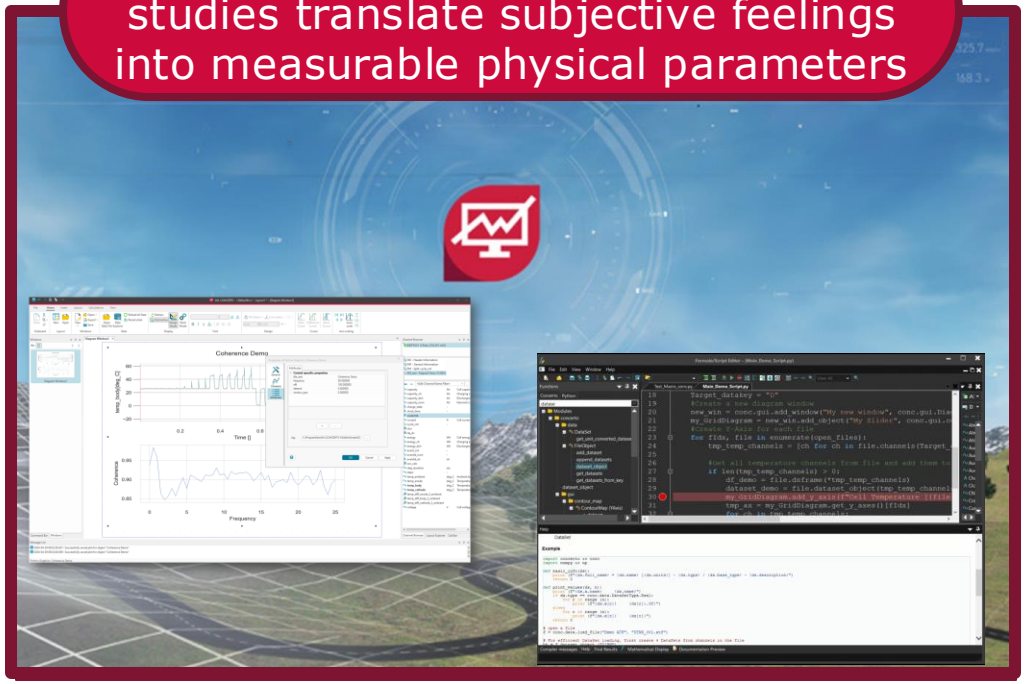
Integrated Development Workflows
Connect CRUISE™ M, FIRE™ M, PreonLab, EXCITE™, and CAMEO into seamless workflows.

Automated Testing & Reporting
Standardize propulsion, battery, and structural test campaigns while reducing manual reporting effort.

Certification Readiness
Ensure data integrity, audit trails, and compliance documentation to support FAA/EASA certification.

Fleet & Mission Data Integration
Incorporate real-world telemetry to validate and refine digital models in closed-loop development.

Algorithms derived from human studies translate subjective feelings into measurable physical parameters



Open for more than 50 different file formats and data sources

Dozen ways to visualize and interact with data, standardized and shareable.

AVL Portfolio: eVTOL Industry

How AVL simulation software is deployed across the eVTOL industry

FOCUS AREA	AVL TOOLS	EXAMPLES
Range & Energy Efficiency	CRUISE M, FIRE M	**Optimize** propulsion & battery size, weight, cooling system
Thermal Safety	CRUISE M, FIRE M, PreonLab	**Prevent** overheating in wildfire conditions. PL for quenching – thermal runaway prevention
NVH & Durability	EXCITE M, FIRE M, CAMEO	**Reduce** vibration, improve sensor stability & component life
Speed	CRUISE M, CAMEO	Run rapid design studies, **accelerate innovation**.
Fleet-Level Ops	CRUISE M, CAMEO, CONCERTO	**Simulate** multi-drone **missions**, optimize charging & coverage
Aerodynamics	FIRE M	**Blade design** optimization
Flight stability	PreonLab	**Payload management**
Controls development	CRUISE M, Model.CONNECT	Faster **controls** development, better controls for maintaining vertical flight earlier
Heat treatment	FIRE M	Increased durability of structural components and rotor blades, **lightweighting**

Vertical Flight Society

Tackle DBVF Challenges through Simulation

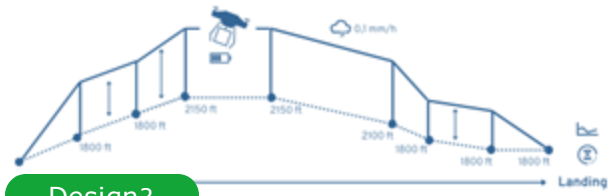
The Role of Drones in Wildfires

Wildfires pose an increasingly serious threat to ecosystems, communities, and infrastructure worldwide. eVTOL aircraft hold significant potential to transform how these disasters are addressed. With their speed, versatility, and rapid deployment, eVTOLs could provide real time surveillance, map fire boundaries, and deliver critical payloads to hard-to-reach areas, offering aerial perspectives and precise operations that could enhance wildfire response while reducing risks to personnel on the ground.

In this year's competition, students are challenged to design an eVTOL aircraft tailored for wildfire missions, with a **focus on speed, maneuverability, autonomous operation,** and **precision in payload delivery** and retrieval.

THE CHALLENGE

Which exciting possibilities can eVTOL technology bring to the future of wildfire management?



Design?

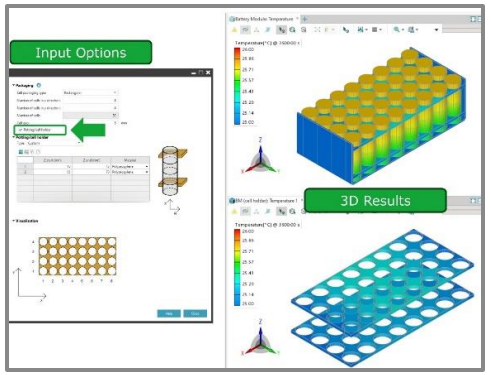
Powertrain?

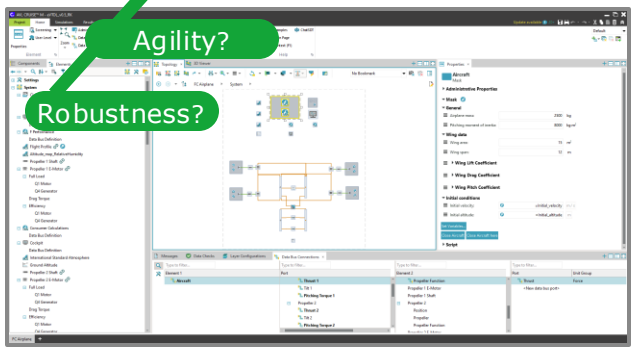
Controls?

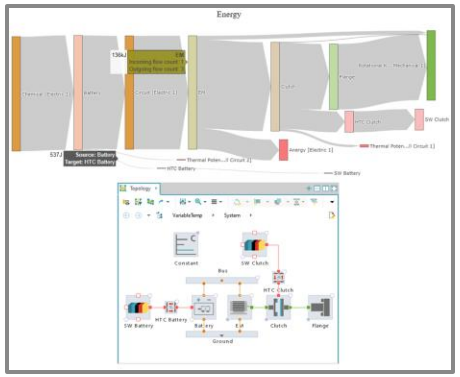
Saftey?

Agility?

Robustness?







Learn how AVLs state-of-the art simulation tools can help to achieve this mission on the following slides.

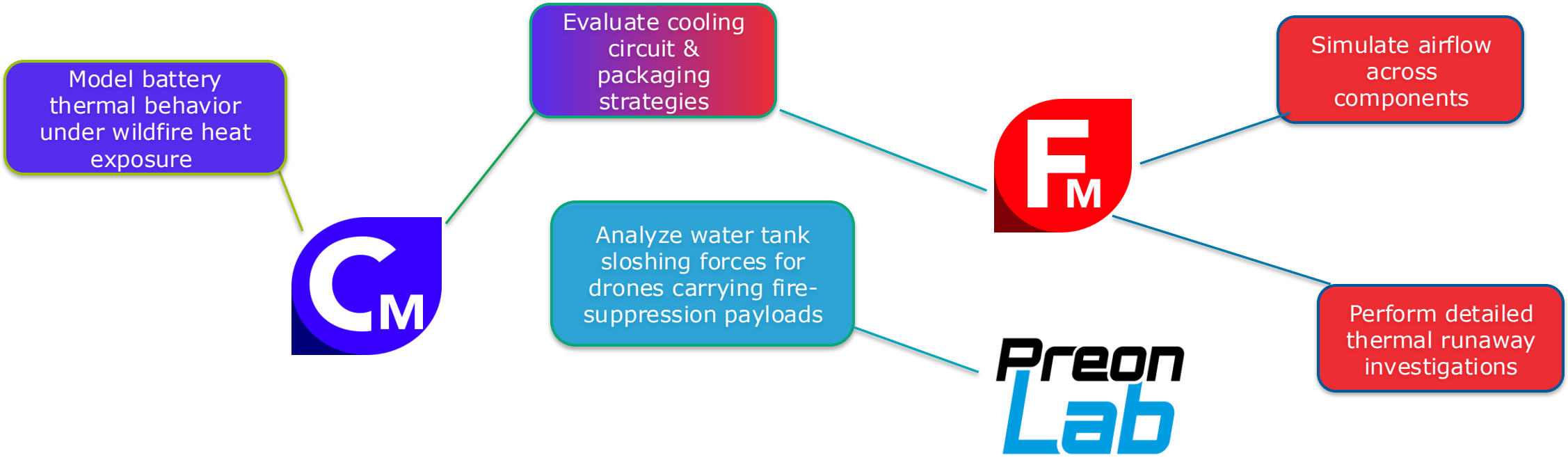
Challenge: Safety

Use Case: Thermal Safety in Harsh Conditions

Challenge: Drones operating in wildfire zones face extreme heat, creating a high risk of battery overheating and failure.

Objective: Design a robust thermal management system for drone batteries and electronics.
Use simulation to evaluate target weight vs. safety while preventing thermal runaway and improving drone reliability.

Tasks:



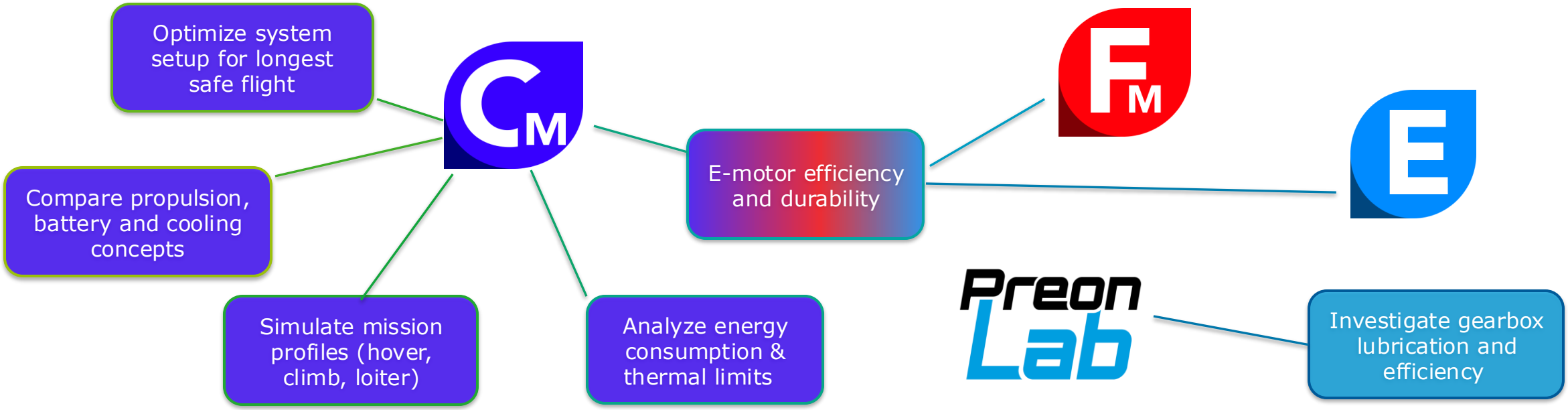
Challenge: Powertrain Capability

Use Case: Drone Endurance & Energy Management

Challenge: Drones must complete long wildfire surveillance missions with limited onboard battery capacity

Objective: Optimize propulsion, battery, cooling systems and control strategy to maximum range and endurance. Demonstrate how energy-aware design can significantly extend drone flight time in wildfire scenarios.

Tasks:



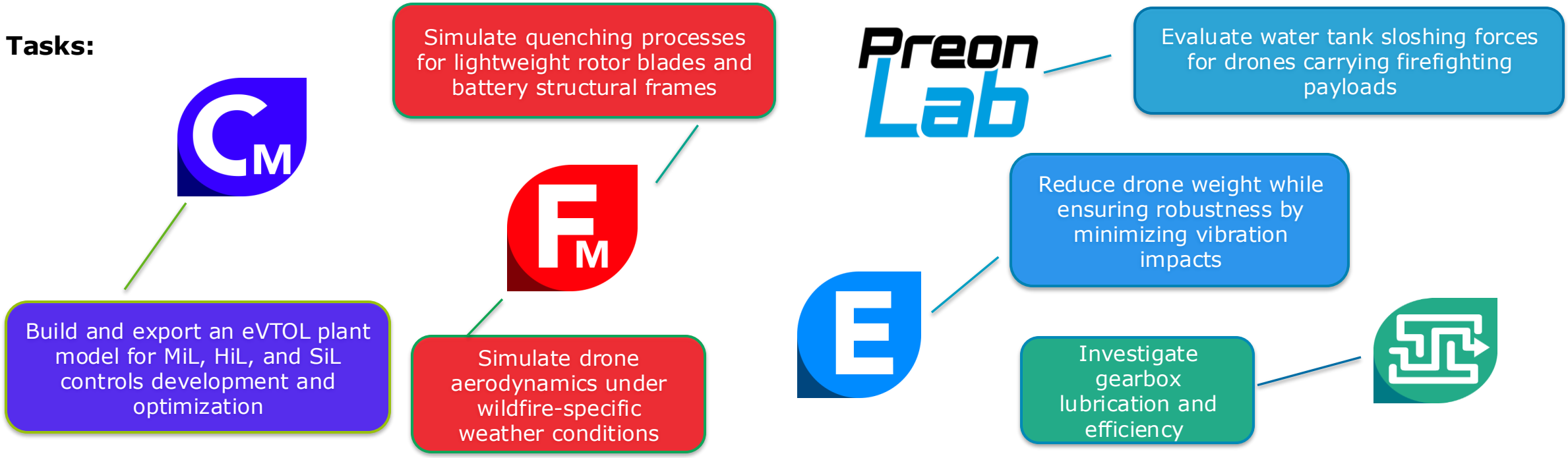
Challenge: Maneuverability

Use Case: Drone Aerodynamics and Controls Optimization

Challenge: Drones must remain stable, responsive, and easy to control while operating in harsh wildfire environments with unpredictable wind and thermal conditions.

Objective: Optimize aerodynamics, weight, and control strategy to achieve maximum maneuverability and robustness in real-world scenarios.

Tasks:



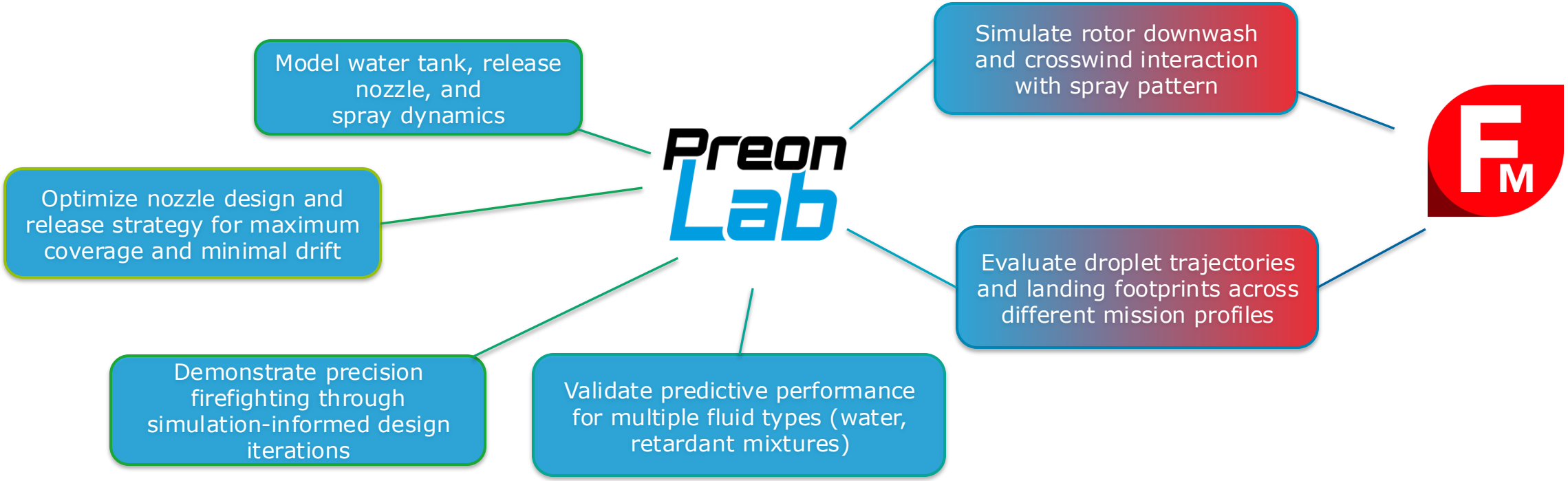
Challenge: Payload Precision

Use Case: FIRE Fighting Payload Delivery

Challenge: Drones and eVTOLs designed for wildfire suppression must deliver water or fire retardant accurately to target areas under variable wind and rotor downwash conditions.

Objective: Optimize water spray formation, and droplet trajectory under realistic wildfire operating conditions.

Tasks:



Contact Us

Interested in AVL Simulation?

Get in Contact → simulation-support.na@avl.com

Industry | Commercial

Thomas
Glatz

Business Development
North America
thomas.glatz@avl.com

Juergen
Schneider

Business and Solution Management
Global
juergen.schneider@avl.com

Academia | Research

Jun
Li

University and Research Partnerships
North America
jun.li@avl.com

www.avl.com/en/university-partnership-program

VFS DBVF Competition Events

Kelli
Harrison

Inside Sales and Marketing
North America
kelli.harrsion@avl.com

www.linkedin.com/showcase/avl-in-north-america-simulation

Thank you

www.avl.com