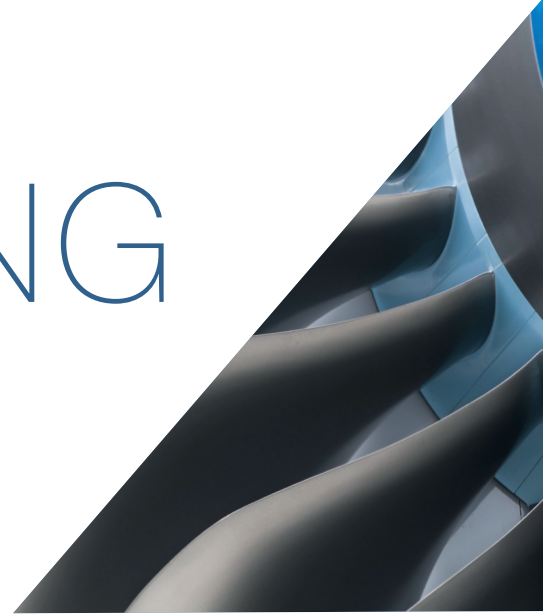


ELECTRIFYING AIRCRAFT

HIL TEST BENCHES FOR ADVANCED &
ELECTRICAL AEROSPACE APPLICATIONS



WWW.OPAL-RT.COM



OPAL-RT
TECHNOLOGIES

ELECTRIFYING AIRCRAFT

Development-parallel testing and simulation.

Boost aircraft performance, reliability, and efficiency through Hardware-in-the-Loop (HIL) testing of your enhanced controls.

With the rapid advancement of the aerospace industry—including **More Electric Aircraft (MEA)**, **all-electric planes**, **eVTOLs**, and **hydrogen fuel-cell aircraft & helicopters**—discover our high-performance HIL simulation technologies, designed to ensure safety for any of your cutting-edge aircraft.

Sustainable aviation through electrifying traditional aircraft.

Recognizing the challenge of **reaching carbon neutrality by 2050**—especially with the rise of ‘single aisle’ aircraft—our solutions support crucial certification efforts for industry compliance. As full electric technologies continue to emerge, our understanding of the **current limitations** in electrifying large carriers facilitates the **sustainable shift in aerospace towards a greener, carbon-neutral future**.



Guaranteed precision for intricate systems, right as of the design phase.

With aircraft systems evolving to include **advanced power electronics**, **intelligent controls**, and **state-of-the-art energy storage**, our HIL digital simulators enable effective planning for you to:

- Secure a **steady power supply**
- Mitigate potential issues tied to **equipment failure** or **aircraft damage**



Harness hydrogen-powered aircraft with our innovative tools.

With the potential to significantly decrease emissions, **hydrogen-powered aircraft** is set to revolutionize the aviation industry. As major players like Boeing and Airbus aim to launch commercial hydrogen-powered aircraft by 2035, the transition towards these groundbreaking technologies is imminent: However, designing aircraft to utilize hydrogen comes with **challenges**, particularly for **storage and weight distribution**.

Our renowned and accurate tools play a pivotal role in overcoming these challenges by **facilitating the design and validation process of novel converter topologies, controllers, or the complete electrical system**, ensuring the seamless integration of hydrogen propulsion systems into aircraft.

Refined toolboxes for complex applications.



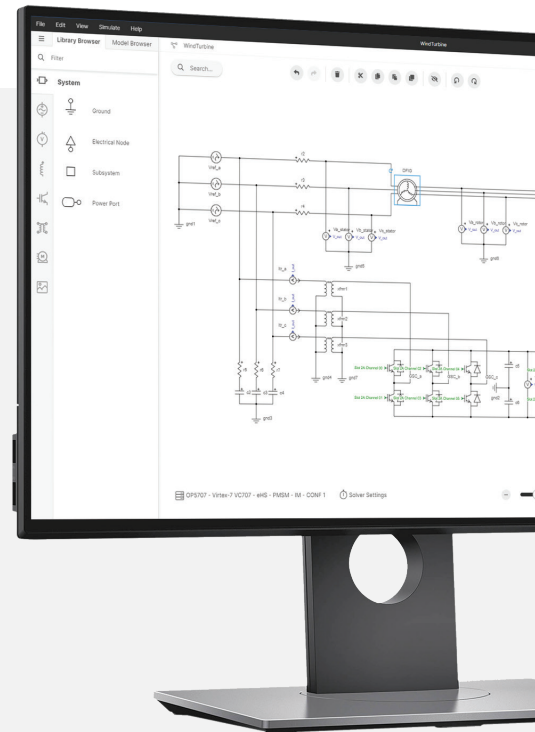
Aircraft grid with ARTEMIS-SSN

ARTEMIS-SSN provides the industry's **fastest and most accurate solvers for aircraft electrical grid simulation on CPU**. With very short lines and thinly coupled grids, standard HIL solving methods can be prevented from work optimally. ARTEMIS solvers and algorithms use advanced decoupling techniques to circumvent this limitation, while providing **accurate HIL simulation results** that you can count on.



E-Motors and power electronics on FPGA with eHS

eHS simplifies FPGA usage for rapid HIL simulation, without the need for low-level coding (like VHDL and XSG) or mathematical modeling. It's a generic and reprogrammable FPGA-based electrical solver that enables users to **bring into real-time any Power Electronics model created in Simscape Power Systems, or other simulation tools of their choice**: PSIM™, PLECS Blockset™, or Multisim™.



[Success stories, technical papers, demos, and more.](#)



ARTEMIS



eHS

ELECTRIFYING AIRCRAFT

Unlock the future of aerospace systems.

Your leading partner for HIL testing in the Aerospace and Defence sectors, with 25+ years of experience.

Find support in achieving required aircraft certifications (such as those **according to DO 178C**) through our systems' compliance with top testing standards and uncompromising accuracy.

Working in aerospace **since the late 90s**, our industry experience has accustomed us to aerospace's high quality demands and project management requirements. We consistently uphold these rigorous standards throughout our project execution process, this commitment demonstrated by our **ISO 9001:2008 certification**.

- **Purpose-built test benches:** Featuring specialized **I/Os and communications protocols like AFDX and ARINC 429**, our test benches are globally recognized for their reliability and effectiveness in real-time verification, validation, and certification of aerospace control systems.
- **Line-replaceable units (LRUs) and complete iron bird configurations:** Our trusted systems for commercial and defence aircraft ensure compliance with the highest safety and testing standards, so you can reach new heights.





Flexible turnkey test benches

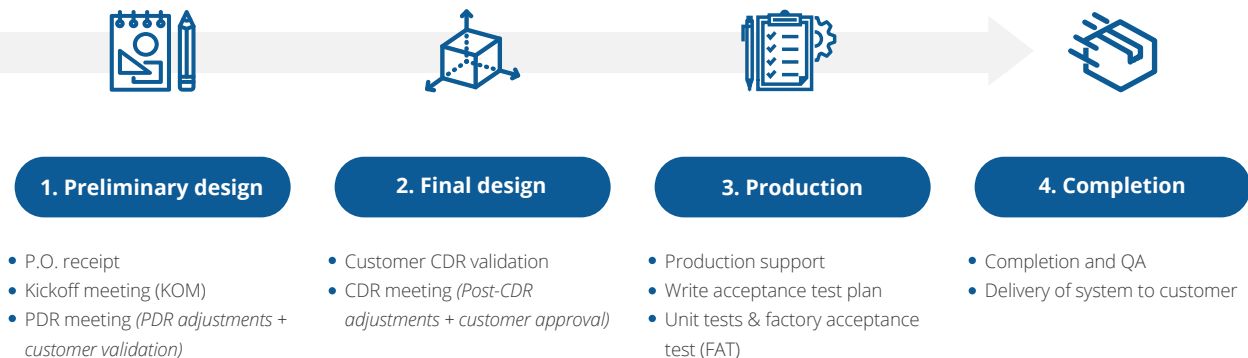
Work with the most affordable, customizable, and scalable turnkey test bench solutions for avionics systems; perfected by over two decades of precise research and development of realistic models.



Future-ready systems

Validate any modern aircraft with our technologies, protocols, and algorithms, crafted for onboard power systems and seamlessly integrated with SimScape Power System for your HIL applications.

A streamlined design and manufacturing process.



Test various traditional aircraft components effectively, accurately, and sustainably.



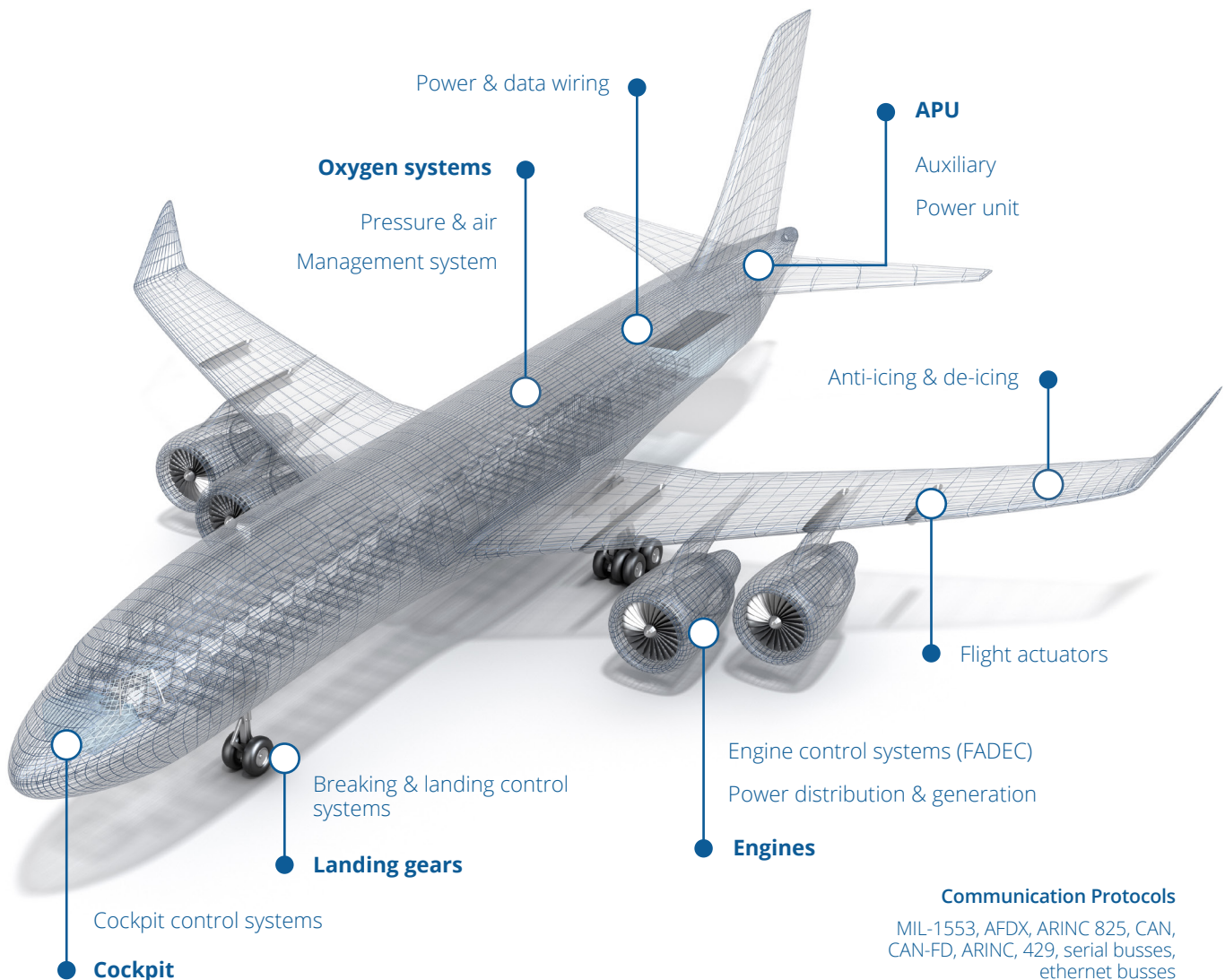
Optimize your project outcomes using our widely adopted solvers & libraries for intricate applications.



Decrease your project expenses while minimizing associated staff and equipment risks.



Expedite your project timelines through the implementation of HIL testing.

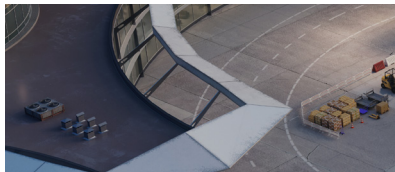


ELECTRIFYING AIRCRAFT

Products and solutions for every application.

Choose OPAL-RT's key aerospace products.

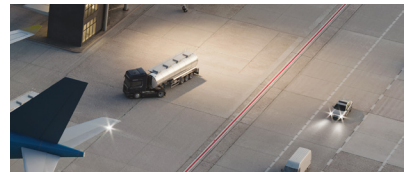
Discover integrated simulator platforms compatible with MATLAB/Simulink® and NI platforms, along with expert assistance for complicated studies in **modeling, simulation, & specialized testing**. Our high fidelity PHIL systems streamline the design, testing, and validation processes for **motor drive control, battery management systems, real power components, controllers, and more**.



More Electric Aircraft
(MEA)



Electric Vertical Take-off
& Landing (eVTOL)



Onboard Power
Systems

Over 2000 users currently
running OPAL-RT.
Worldwide.



AIRBUS ← **EMBRAER**
GROUP



During setup and installation, the OPAL-RT team was very supportive and responsive [...] The documentation, examples, and training provided by OPAL-RT helped to set up the system in no time.



Akshat Yadav

Power Electronics Engineer at magniX

[Discover all our expert aerospace solutions and offerings:](#)





magnix revolutionizes commercial aviation with OPAL-RT'S HIL simulation.

Commercial aviation, bound by strict safety regulations, rarely witnesses rapid changes in design. However, on December 10, 2019, in Vancouver, magnix and Harbour Air Seaplanes conducted the world's first commercial electric airplane flight. The **eBeaver**, a **modified de Havilland DHC-2 Beaver powered by a 560kW electric propulsion system**, marked a significant leap in the carbon-heavy aviation sector.

Within six months, magnix tested the electrically-propelled **Cessna 208B Grand Caravan (eCaravan)**, a larger aircraft than the eBeaver. Technological breakthroughs, including highly optimized electric motors and advancements in power electronics efficiency, played pivotal roles. Despite challenges posed by battery technology, short regional routes, like those flown by Harbour Air, emerged as an ideal market for electric aircraft.

magnix aimed to **rapidly test the electric propulsion controller software for the eBeaver and eCaravan projects**. To meet this challenge, the **OPAL-RT real-time simulator was employed to simulate motor and inverter hardware**. This allowed the integration and validation of control software on the prototype controller module, enabling iterative changes before physical modifications.

The simulation started with a simple R-L load model, progressively integrating the complete motor model using the **FPGA-based Power Electronics Toolbox (eHS)**. The real-time measurements of essential parameters provided insights, facilitating successful controller integration. Automation through the Python-based API saved time and reduced errors. OPAL-RT's simulator aided in rapid modeling, emulation, and bug fixing during the initial stages of development.

Iterative development and **Hardware-in-the-Loop (HIL)** validation using OPAL-RT led to the successful development and validation of the control software for the magniDrive inverter, integrated into the magni500 propulsion system. This system powered the world's first commercial electric aircraft (eBeaver) and the world's largest all-electric commercial aircraft (eCaravan). Notably, **the power cost for the eBeaver's 30-minute flight was \$8.20**, significantly lower than the standard beaver's fuel cost of approximately \$135.00 for the same flight.

[Read the full success story:](#)





OPAL-RT TECHNOLOGIES

Founded in 1997, OPAL-RT TECHNOLOGIES is the leading developer of open real-time digital simulators and Hardware-in-the-Loop testing equipment for electrical, electro-mechanical and power electronic systems.

Our simulators are used by engineers and researchers at leading manufacturers, utilities, universities, and research centres around the world. Our unique technological approach integrates parallel, distributed computing with commercial off-the-shelf technologies.

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