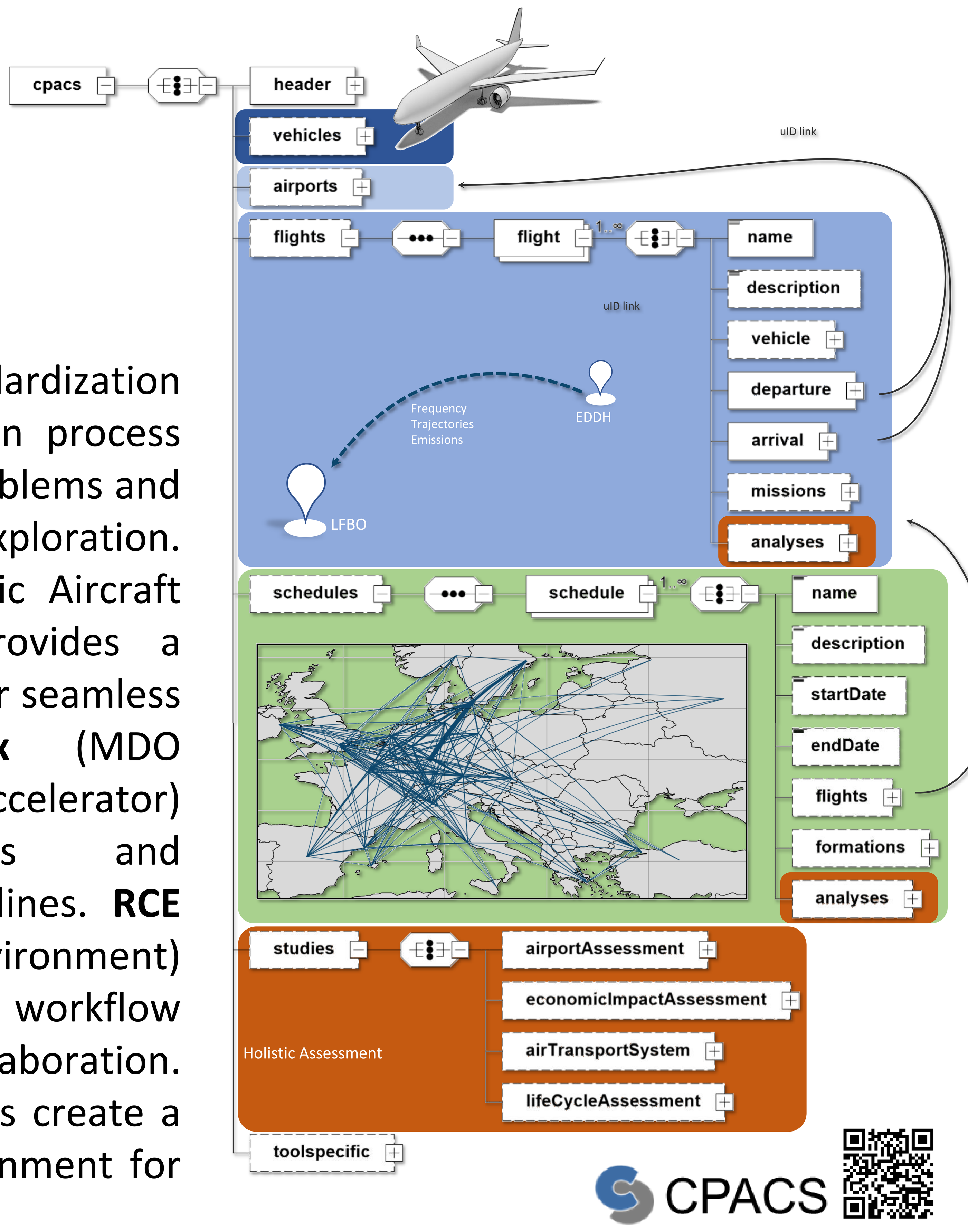
#ArchitectingAviation

Digitizing Aviation Through A Collaborative Design Framework

Digital methods and technologies to improve collaboration between discipline specialists to automate and accelerate the aircraft design process

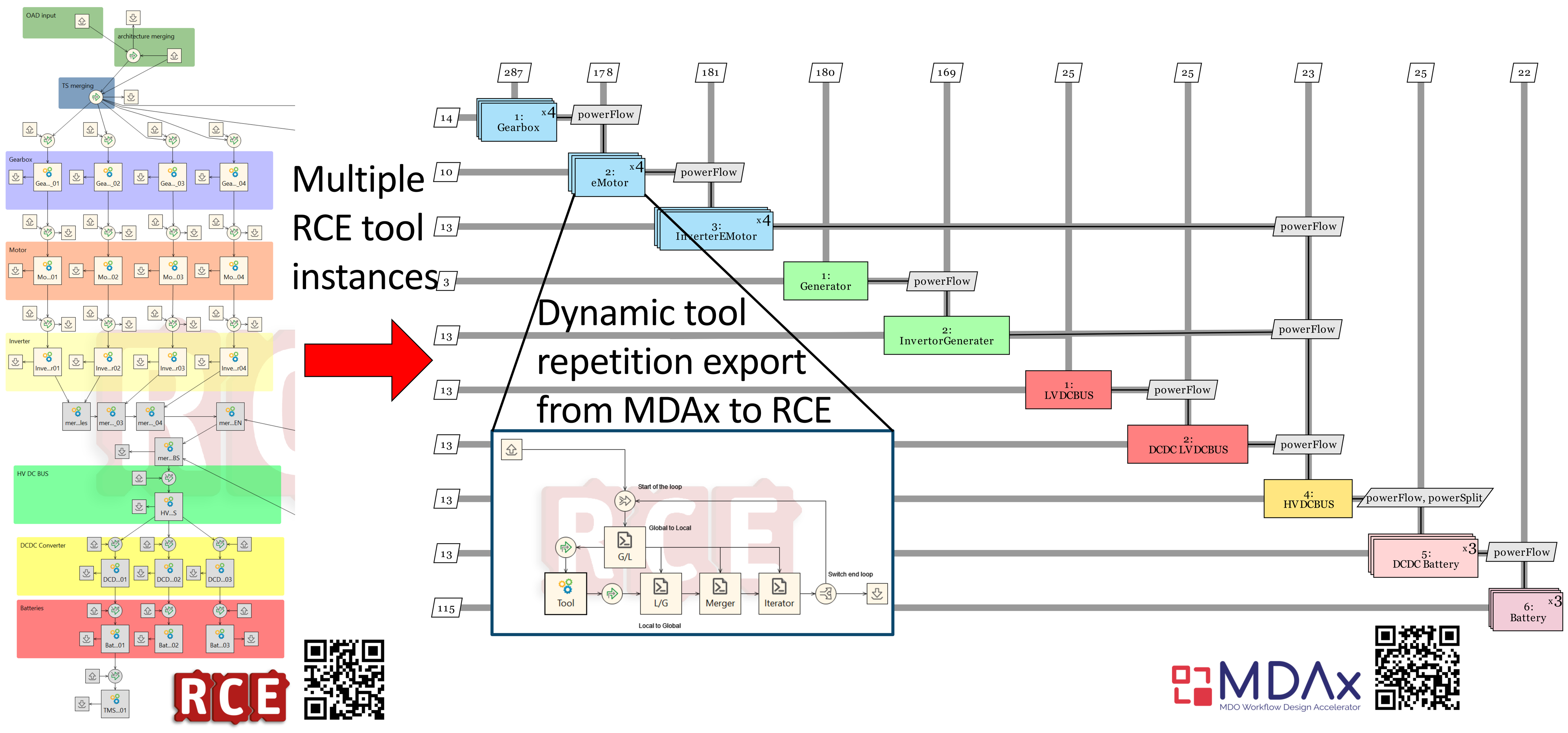
Digitization and standardization enable an integrated design process that reduces integration problems and accelerates design space exploration. **CPACS** (Common Parametric Aircraft Configuration Schema) provides a standardized data format for seamless exchange, while **MDAx** (MDO Workflow Design Accelerator) orchestrates simulations and optimizations across disciplines. **RCE** (Remote Component Environment) facilitates distributed workflow execution and team collaboration. Together, these components create a flexible and efficient environment for innovative aircraft design



The CPACS data model was extended with revised definitions for *airports, flights, schedules,* and *studies* at the ATS level, while *trajectories* and *missionDefinitions* were updated to better reflect realistic flight plans and sequences. These advancements were carefully coordinated and synchronized between internal DLR projects, EXACT2 and ALICIA, to ensure consistency and integration. Further developments covered hydrogen tanks and the extension of the TiGL geometry library to visualize and evaluate its geometry.

MDAx enables automated and user-friendly modeling of dynamic workflow behavior, which was used to enhance the electric drivetrain workflow. Two key aspects are: (1) the same RCE tool being used for different component blocks and (2) multiple instances of a single tool needed to address multiplicity of components. A dynamic workflow in MDAx removes the need for multiple RCE tool block instances while ensuring flexibility for varying tool multiplicity.

Mixed-Fidelity MDAO Workflows leverage pre-modeled analysis workflows from MDAx, integrating low/mid-fidelity capabilities from the RCE/CPACS stack with high-fidelity methods from FlowSim. Optimization is driven by MDAO frameworks like OpenMDAO. OpenMDAO4RCE enables seamless access to RCE network components with two-way mapping between CPACS and system states.



EXACT Turbofan Baseline

D250-TF-2040

Entry into Service	2040
Range (km)	2778
Passengers	250
Wing Span (m)	42
Maximum Take-Off Mass (t)	80.9
Cruise Mach Number	0.78
Cruise Speed (km/h)	832.7
Energy Carrier	Synth. Kerosene
Energy Consumption	13.2
Total Installed Power (MW)	42

EXACT Turbofan LH2 Hybrid

D250-TFLH2-MHEP-2040

Entry into Service	2040
Range (km)	2778
Passengers	250
Wing Span (m)	42
Maximum Take-Off Mass (t)	82.7
Cruise Mach Number	0.78
Cruise Speed (km/h)	832.7
Energy Carrier	LH2
Energy Consumption	13.6
Total Installed Power (MW)	41.6

The results generated in the project are stored in a formal and centralized storage location, called **digital hangar**, from where they can be retrieved and inspected by all project participants. As the digital hangar acts as the single source of truth, it ensures that only the most up-to-date results are used for further analyses.

The D250-TFLH2-MHEP-2040 is a short-haul aircraft concept from DLR's EXACT project, designed to carry 250 passengers with a Mach number of 0.78 (~833 km/h at 35000 ft altitude) and a range of 1500 NM (2778 km). The year of entry into service (EIS) is 2040. The energy carrier is liquid hydrogen (LH2), which powers the Mild Hybrid Electric Propulsion (MHEP) architecture consisting of two gas turbines and fuel cells. The MHEP architecture enables more efficient off-design operation, which reduces energy consumption, especially on shorter missions.

The most important differences to today's short-haul aircraft are:

1. Mild-Hybrid-Electric-Propulsion (MHEP) architecture consisting of two gas-turbines and fuel-cells.
2. The energy carrier liquid hydrogen (LH2)
3. Foldable wingtips to increase the aerodynamic efficiency and still fit into the 36m gate limit.

Key Characteristics

Entry into Service	2040
Range (km)	2778
Passangers	250
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Maximum Take-Off Mass (t)	82.7
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Downloads

CPACS Parametrisation

Geometry

.STEP .IGS .STL .DAE .VTP .PLY .BREP

Technical data sheet

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