



Dedicated to innovation in aerospace

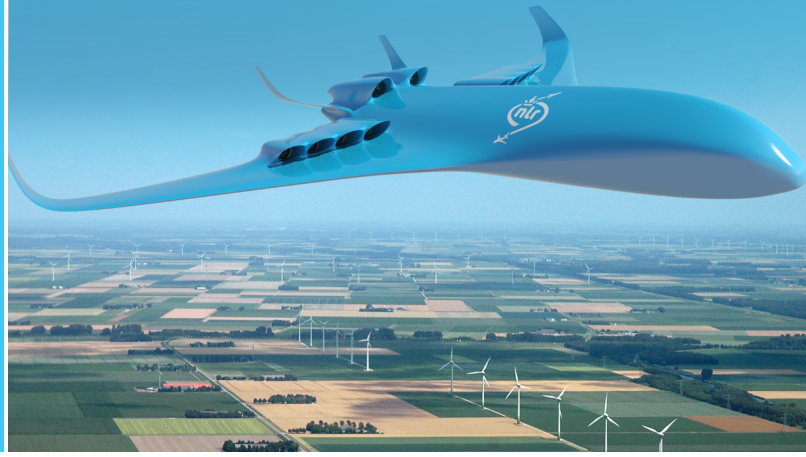
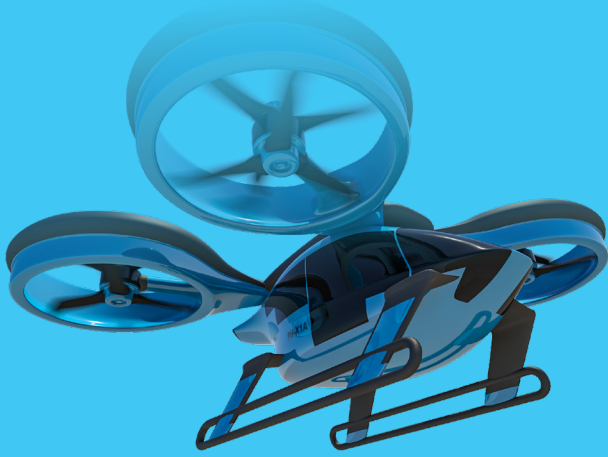
# Analyse the energy performance of aircraft?

PRODUCTS & SERVICES



## Efficient simulation capability for mission performance and technology scenario analysis of aircraft

The increasing environmental impact of air travel puts a strong challenge on the aircraft industry to come up with innovative technologies. Aircraft with (hybrid-)electric propulsion and/or alternative fuels are being investigated as potential solutions. But, to what extent will they solve the environmental impact problem? Energy performance analysis at aircraft level is needed to evaluate the various proposed technologies, for different aircraft types.



## WHAT YOU NEED

Insight

- in the feasibility of alternative propulsion and power systems on various aircraft types: e.g. as retrofit on existing aircraft types or on new and radical aircraft concepts;
- in the potential environmental impact reductions on future aircraft;
- in the impact of various technology prospects on future aircraft energy performance;
- in the technology requirements to fulfil different "What If" scenarios.

## WHAT WE DELIVER

Energy performance simulations of aircraft

- for existing aircraft types or for future concepts;
- with varying system configurations, e.g. with alternative propulsion and power solutions such as hybrid-electric, more electric or hydrogen based systems;
- for various system technology scenarios;
- including mission evaluation and optimisation in terms of fuel, energy and emissions;
- following a multidisciplinary approach, with models of various complexity levels, depending on the needs.

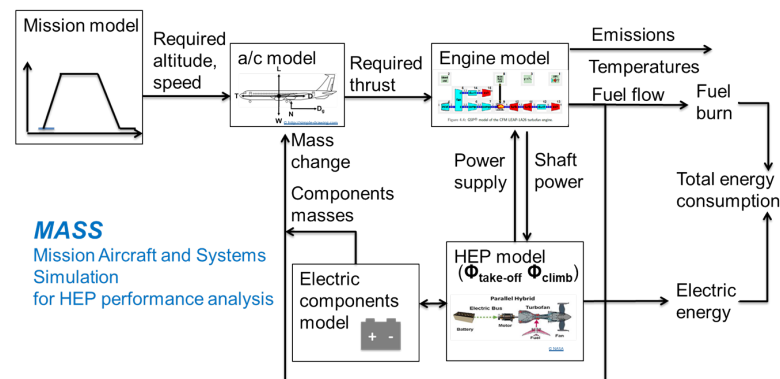
## OUR CAPABILITIES

The analysis of the energy performance of various aircraft types is carried out by modelling and simulation. An efficient tool chain of parametric models for mission performance analysis has been developed in MATLAB. This tool chain 'MASS' (Mission, Aircraft and Systems Simulation) simulates the performance of a specified aircraft configuration, including engines and power systems, for a given mission. The fuel flow and total power are calculated as function of mission time in order to predict the total trip energy consumption. Furthermore the engine emissions are calculated. System models of various complexity levels can be applied, depending on the needs. The various model parameter values can be either specified by customers or can be derived from public databases or from NLR in-house sources.

## OUR CAPABILITIES

What can be achieved with the MASS tool chain:

- Extensive parametric studies and scenario analyses for various aircraft types, ranging from drones to large passenger aircraft;
- Energy performance optimisation for existing configurations and for future concepts;
- Evaluations of alternative propulsion and power concepts, such as (hybrid-)electric systems, more electric or hydrogen based systems;
- Management and optimisation strategies of alternative power systems.



## PRODUCTS & FEATURES

With MASS (Mission, Aircraft and Systems Simulation) tool chain Royal NLR can deploy efficient tooling for extensive analyses and optimisations of aircraft energy performance: less than 10 s calculation time per configuration-mission combination. Models of various complexity levels can be applied, depending on the needs.