Sustainability and Aerospace make flying carbon neutral

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What does increased focus on sustainability mean to the aerospace industry?

- Allows aviation industries to work towards full sustainability
- Delivers lighter, more fuel efficient aircraft, be they military or commercial
- Ensures sustainability is at heart of design and product manufacturing processes
- Supports climate neutral business growth
- Promotes further democratisation of air travel, connecting more people globally
- Contributes to environmental protection through emissions and noise reductions
- Allows the Aviation industry to further grow and fulfil the propensity to fly to an ever increasing middle-class

Why is sustainability important for those in the aerospace sector?

The highly visible aviation industry is under great pressure to reach carbon neutrality as it produces unwanted noise pollution and 2.5% of global carbon emissions.

The industry has a long, continuous history of modifying aircraft structures and systems to reduce noise and designing more efficient engines to reduce harmful gas emissions, but political, economic and social pressures have further increased the need for aviation to become climate neutral.

However, the demand to fly also continues to grow, particularly in China and the Middle East with the expansion of more affluent middle classes who wish to enjoy the privileges of global connectivity once only available to the wealthiest.

These two, potentially conflicting forces, have created new engineering challenges which target the demand for safe, more sustainably manufactured and operational aircrafts and their ecosystems.

In the aerospace industry, who can benefit from investments on sustainability, today and into the future?

Complex engineering problems such as the development of hydrogen fuel cells, synthetic fuels and hybrid electrical propulsion systems require new digital tools and methods to deliver climate-neutral aircraft and reduce use of energy and materials in design, manufacture and operations.

These methods and tools will empower engineers to better produce well specified structural and systems architectures which meet operational compliance standards whilst also attaining climate neutrality throughout the product life cycle. Producing aircraft which are safe and carbon neutral, verifiably compliant with, not just global safety requirements, but with the growing volume of environmental and sustainability regulations, requires new methods to meet their design and engineering challenges.

Airlines already require standard metrics and have KPIs with many sustainability requirements when buying new aircraft; this trend will only increase as governments and airline passengers focus more and more on sustainability and the climatic impacts of flying. Airports which have had their operations constrained by noise and emission regulations and face huge objections from local people and climate activists over expansion, will also prefer to favour aircraft which are carbon neutral, quiet and have the lowest possible harmful emissions.

Within aviation companies, many are exploring ways of safe electrical propulsion, modifying gas turbines to hydrogen or transition propulsion systems from kerosene to synthetic fuels.

Model Based Systems Engineering (MBSE) helps in delivering the tools and workflows to meet these complex challenges whilst allowing increased focus on the energy needed for product and manufacturing processes.

Creating value and return from investments in sustainability within the aerospace sector

Aviation can work towards being climate neutral in different ways. This might be through powerful electrical propulsion systems requiring energy sources that are atypical for current aircraft; whether they be batteries, hydrogen systems or synthetic aircraft fuels. There is also the challenge of modifying existing motors to burn hydrogen.

Aircraft design has always evolved, but the twin demands of sustainability and commercial viability are driving dramatic change - a revolution in aircraft design.

Moreso, the development methods, tools and processes, in particular those used for the development of past aircraft, aren't fully able to address the engineering challenges related to the integration of many of these new energy sources and their related systems. To be achievable all the routes to more sustainability require high levels of modelling and simulation often with a focus on the physics of combustion, hydrogen for example or on novel mathematical and data models.

The use of digital twins (virtual models of components, systems or completed products) in the iteration and operation of aircraft systems saves significant costs in development as well as energy and material resources and delivers verifiable sustainability. Inherent within the methodology of MBSE is the ability to define product requirements such as noise levels or emissions and conduct on-going analysis and performance enhancement through the lifecycle of development.

MBSE has the digital tools and workflows that deliver manageable and performant design programmes for aircraft development that helps to ensure to-budget, verified, compliant, safe and sustainable programs.

Focus on sustainability delivers added value to defence and aerospace sectors

- Minimises the likelihood of failure of the project
- Delivers significant reduction in change orders during manufacture
- Reduces significantly late change costs
- Improves and future proofs design
- Improves sustainability targets through less weight and CO2 emissions
- Delivers shorter development cycles and faster delivery of product
- Delivers much less onerous EE certification
- Delivers significant ROI through fewer errors and faster manufacture