HOW TO TACKLE THE CHALLENGES OF EVTOL AIRCRAFT

The development of personal or urban air mobility aircraft presents several engineering challenges

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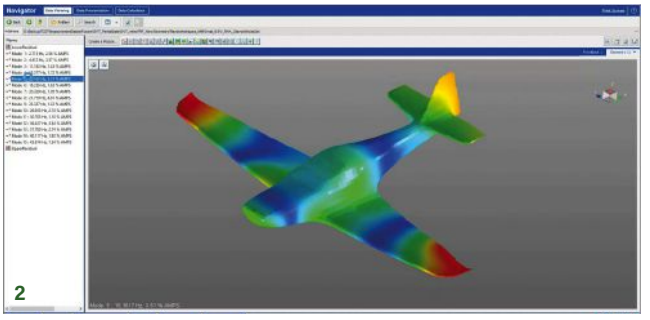
The world of aviation is changing. eVTOL aircraft are opening up new horizons for enhanced mobility. Personal or urban air mobility (UAM) concepts are flourishing. But these innovations bring implications.

In an urban environment already saturated with high traffic noise levels, it is of utmost importance that those urban flights operate as quietly as possible. Given the stringent regulations for reduced emissions, we see many aircraft manufacturers design and develop innovative aircraft architectures and lightweight structures that use composite materials. The electric propulsion systems, for example, offer more possibilities for disruptive aircraft configurations. However, these new architectures and materials bring uncertainties around the aircraft's structural dynamics performance. They increase the workload required to validate and tune their performance while the time constraints to reach aircraft certification remain. Engineers strive to meet tight program deadlines. The issue is that they lack both experience and physical data about these next-generation aircraft's structural dynamics performance.

There are as many aircraft variants as there are companies making them. The development of new electric propulsion systems and the evolution in material composition and designs change the industry. As the industry learns every day from experimental aircraft, manufacturers need to address specific issues to ensure the safe operation of next-generation aircraft. So, how are we tackling these challenges and keeping up with trends and regulations?

We at Siemens see the many advantages of the integrated test and simulation approach to tackling these—mainly using a digital twin. The digital twin allows you to fly an aircraft before it is built. This means that you save cost and time on demonstrators and prototypes. The tight integration of test and simulation tools — in support of test preparation, model validation, or virtual sensing—is even more critical today when designing and developing innovative aerial vehicles. This integration helps to address better the unknowns linked to the usage of new materials or innovative configurations.



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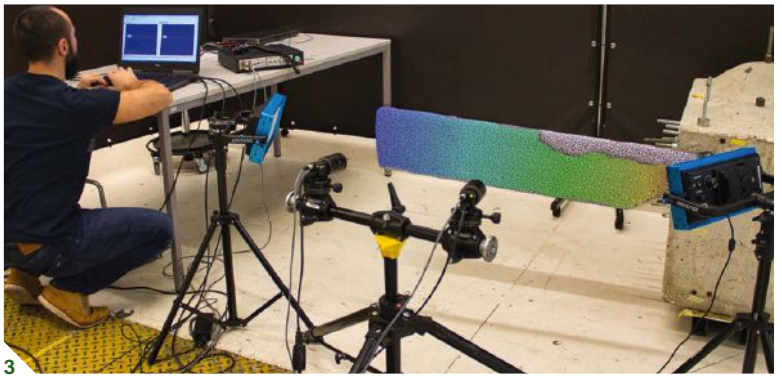
By relying on digital cameras, the digital image correlation (DIC) technique in Simcenter Testlab allows measuring everything contactlessly, and 3D full-field deformation, strain, and stresses can be obtained with a very fine spatial resolution. Images recorded during the test are analyzed, and displacements can be obtained with sub-pixel accuracy. DIC offers excellent capabilities for efficiently validating complex aerospace materials at coupon level or at integrated structure level by providing full-field information with limited instrumentation.

Regarding noise pollution, efficient aircraft acoustic engineering is the single most effective countermeasure. And its importance will only increase with the advent of the next-generation aircraft. In consequence, how can aviation engineering teams efficiently troubleshoot noise issues? How can they develop quieter aircraft designs without compromising their weight and performance objectives? And how can they realize substantial aircraft noise reduction?

Engineers must quickly and accurately pinpoint the origin of irritating noises and act on the root cause of acoustic problems and their transfer paths to lower sound levels. They must also select appropriate noise-damping materials and parts. With Simcenter Testing Solutions, engineers can target noise objectives for fly-over noise according to governmental regulations and facilitate in-flight operational acoustic measurements that deliver maximal insights into the acoustic behavior. And by engineering sound design not just for the outside, but for the inside of the aircraft, engineers can also optimize cabin comfort. \\



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1 // This next-generation aircraft, a concept of an air taxi, will require airworthiness and noise certification prior to its commercialization.

2 // Simcenter helps engineering teams gain insights into aircraft structural dynamics.

3 // Measurement set-up for digital image correlation for structural behavior of a rotor blade.