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Case Study

Ground Vibration Test of Eight-Rotor eVTOL Aircraft

OVERVIEW

Vertical Aerospace is pioneering electric flight, enabling the transition to a future of sustainable aviation by developing the VX4, an innovative piloted electric vertical takeoff and landing (eVTOL) aircraft. The development of this aircraft required a ground vibration test (GVT) to validate and update the aircraft structural dynamic model. The measured frequencies, mode shapes, and damping from the GVT were ultimately used to tune the analysis model and validate the aircraft. ATA supported Vertical Aerospace by executing the GVT program, including pretest analysis and planning, equipment installation, testing, on-site data analysis, and reporting. The GVT was part of a larger Phase 1 test program, which included tethered flight of the aircraft, critical to moving the VX4 closer to commercial introduction.

TASKS PERFORMED & KEY OUTCOMES

- Completed pretest analysis and planning in San Diego, California. All equipment and ATA test personnel traveled to Cotswold Airport in Kemble, United Kingdom, for test execution.
- Developed aircraft soft support system for a simulated free-free boundary condition.
- Tested four aircraft configurations with rotors in various positions.
- Mounted eight shakers to the wing tips, tail tips, and four rotor hubs, and measured over 270 response degrees of freedom (DOFs) with accelerometers during the test.
- Identified all global aircraft primary modes, as well as numerous other modes below 125 Hz, across the four test configurations while the vehicle was suspended on bungees.
- Performed detailed impact testing of the nose boom and one motor with the vehicle resting on gear, linearity studies for each configuration, and independent investigations of the primary modes of the control surfaces.
- Completed setup, testing, and teardown in less than one week.

VX4 rotors up

VX4 rotors mid-tilt

VX4 rotors down