Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

ACTIVE AEROELASTIC WING PARAMETER IDENTIFICATION FLIGHTS COMPLETE

Active aeroelastic wing (AAW) technology can benefit future aircraft designs including unmanned air vehicles, advanced transports, and advanced fighter concepts such as future strike. Design studies have shown that the technology can decrease aircraft weight 5%–20%, depending on the mission.

When applied to fighters, the AAW design approach enhances maneuverability by increasing wing control power and improves roll rate at higher dynamic pressures. AAW wings provide large amounts of roll power using conventional control surfaces while controlling air loads and reducing overall aircraft drag. In high altitude, long endurance aircraft, AAW technology can be used to alleviate gust loads and to manage wing warping to increase aerodynamic efficiency.

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Accomplishment

The Air Vehicles Directorate, in cooperation with the National Aeronautics and Space Administration Dryden Flight Research Centers, and Boeing Phantom Works, successfully completed the first phase of flight research for the AAW. The test platform was an F/A-18A modified with a split, leading-edge flap drive system, a modified flight control computer, and a flexible wing with thinner skins that allowed the outer wing panels to twist up to 5°.

More than 1,600 sensors on the F/A-18A measured parameters such as control surface positions, wing deformation, structural strain, frequency response, and accelerations. Engineers will use this parameter identification data to develop new AAW flight control laws and to design guidance for future AAW applications.

Background

AAW is a multidisciplinary, synergistic technology that integrates air vehicle aerodynamics, active controls, and structures together to maximize air vehicle performance.

The concept turns wing aeroelastic flexibility into a net benefit through the use of multiple leading and trailing edge control surfaces activated by a digital flight control system. AAW techniques use air stream energy to achieve this desirable wing twist with very little control surface motion. The wing then creates the needed control forces with outstanding effectiveness. When AAW technology is applied correctly, the wing will twist less (although in an opposite direction) than a conventional wing twists during maneuvering. AAW technology will enable future designers to consider higher aspect ratio and thinner wings with less structural weight than current wing designs.

Air Vehicles
Support to the Warfighter

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (03-VA-10)