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Introduction: Abrupt Wing Stall Program, Part 2

This is the second issue of the *Journal of Aircraft* to highlight a series of papers summarizing the Abrupt Wing Stall (AWS) program, which was a cooperative program among NASA, Department of Defense, industry, and academia. This program resulted from the discovery of wing drop during the flight test program of the F/A-18E/F prototypes. Even though the flight deficiency was corrected, it was obvious that there was a lack of understanding why that aircraft experienced wing drop while its predecessor, the F/A-18C/D did not. It was also apparent that wind tunnel testing and computational fluid mechanics lacked clear metrics for predicting this flight deficiency with reliability. Consequently, the AWS Program was launched to address these technological shortcomings.

The papers presented in these two issues highlight the technical work accomplished by the following partners that participated within the program: NASA, U.S. Navy, U.S. Air Force, The Boeing Company, Lockheed Martin Corporation, U.S. Air Force Academy, Naval Post Graduate School, Naval Academy, Princeton University, Virginia Polytechnic Institute and State University, and University Notre Dame. The scope of this work included efforts to fundamentally understand the flow process occurring over a wing panel. However, a larger part of the effort was to provide test and computational procedures to predict, for future vehicles, uncommanded lateral motions before reaching the stage of flight test where "fixes" are both difficult to determine and very expensive to implement.

The May–June 2004 issue of the *Journal of Aircraft* introduced the reader to the background that led to the establishment of the AWS Program, summarized an historical overview of relevant previous work, and then focused on a number of experimental papers. These experimental papers describe attempts to arrive at static figures of merit to predict uncommanded lateral motions during conventional wind tunnel testing, develop the background leading to the fabrication of a free-to-roll fixture for transonic tunnels, provide a summarized analysis of the free-to-roll experimental data, provide a summary of unsteady pressure measurements made through the wing drop region, and finally provide recommendations for experimental testing of future vehicles.

Part 2 of the Abrupt Wing Stall special section spans computational, experimental, flight test, and flight simulations studies. A CFD overview paper is presented first and is followed by an experimental paper summarizing observations in surface pressures. The following paper will compare the flowfields about the F/A-18E and the F-16C. Next, state-of-the-art unsteady calculations of the flow about the F/A-18E wing using a Detached-Eddy Simulation (DES) analysis will be presented. A study of the various geometric wing changes made in going from the F/A-18C to the F/A-18E wings will then be presented that will address the reasons why the F/A-18E had the challenge of wing drop while the F/A-18C did not. General recommendations for CFD evaluations will then close out the computational work. Next, a flight test paper outlines the development by The Boeing Company of a very successful flight metric after the wing drop resolution effort to correlate pilot comments to flight engineering data. A simulation paper then demonstrates the utility of fixed-base simulators to approximate the feel of wing drop. The last two papers summarize the importance of employing lessons learned during the AWS program to reduce risk for future programs, as well as, the gains in the state of the art achieved.

The AWS Program would like to recognize some individuals that were critical to the advocacy and execution of the program. The first acknowledgement goes to James Godwin, who was in charge of the F/A-18 Program Office at the time of the wing drop resolution process. To his credit, and that of the U.S. Navy, he encouraged studies of the abrupt stall process even after the F/A-18E/F program was corrected because he did not want any future program to go through the same difficulties that the F/A-18E/F Program underwent. Rich Gilpin and Greg Drohat of the F/A-18 Program Management Office were instrumental in loaning the Navy models to NASA, as was Tom White from the AV-8B Program Management Office. Don Dix of the Fixed Wing Vehicles Program was also instrumental in advocating for this program. Frank Berrier coordinated assistance from The Boeing Company and Russ Killingsworth coordinated assistance from the Lockheed Martin Corporation. Next, it is important to acknowledge the individuals at NASA that led the AWS Program from a programmatic perspective, Jeffrey Yetter and Long Yip. Similarly, from the Office of Naval Research, we received valuable program direction from Lawrence Ash. Finally, we would like to express our appreciation to Joseph Chambers, who was funded by the U.S. Navy and served as a consultant to the technical team. His extensive experience, encouragement, and excitement were integral to the success of the AWS Program.

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Guest Editor