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20050185552 NASA Langley Research Center, Hampton, VA, USA

Aeroelastic Deformation: Adaptation of Wind Tunnel Measurement Concepts to Full-Scale Vehicle Flight Testing

Burner, Alpheus W.; Lokos, William A.; Barrows, Danny A.; [2005]; 17 pp.; In English; RTO/AVT-123 Symposium on Flow Induced Unsteady Loads and the Impact on Military Applications, 25-29 Apr. 2005, Budapest, Hungary

Contract(s)/Grant(s): 23-064-50-22

Report No.(s): RTO-MP-AVT-124; No Copyright; Avail: CASI; A03, Hardcopy

The adaptation of a proven wind tunnel test technique, known as Videogrammetry, to flight testing of full-scale vehicles is presented. A description is presented of the technique used at NASA's Dryden Flight Research Center for the measurement of the change in wing twist and deflection of an F/A-18 research aircraft as a function of both time and aerodynamic load. Requirements for in-flight measurements are compared and contrasted with those for wind tunnel testing. The methodology for the flight-testing technique and differences compared to wind tunnel testing are given. Measurement and operational comparisons to an older in-flight system known as the Flight Deflection Measurement System (FDMS) are presented.

Author

Aeroelasticity; Flight Tests; Wind Tunnel Tests; F-18 Aircraft; In-Flight Monitoring; Photogrammetry

20050192434 NASA Langley Research Center, Hampton, VA, USA

Actively Controlling Buffet-Induced Excitations

Moses, Robert W.; Pototzky, Anthony S.; Henderson, Douglas A.; Galea, Stephen C.; Manokaran, Donald S.; Zimcik, David G.; Wickramasinghe, Viresh; Pitt, Dale M.; Gamble, Michael A.; [2005]; 12 pp.; In English; RTO/AVT-123 Symposium on Flow Induced Unsteady Loads and the Impact on Military Applications, 25-29 Apr. 2005, Budapest, Hungary; Original contains color illustrations

Contract(s)/Grant(s): 23-745-45-43

Report No.(s): RTO-MP-AVT-123; No Copyright; Avail: CASI; A03, Hardcopy

High performance aircraft, especially those with twin vertical tails, encounter unsteady buffet loads when flying at high angles of attack. These loads result in significant random stresses, which may cause fatigue damage leading to restricted capabilities and availability of the aircraft. An international collaborative research activity among Australia, Canada and the USA, conducted under the auspices of The Technical Cooperation Program (TTCP) contributed resources toward a program that coalesced a broad range of technical knowledge and expertise into a single investigation to demonstrate the enhanced performance and capability of the advanced active BLA control system in preparation for a flight test demonstration. The research team investigated the use of active structural control to alleviate the damaging structural response to these loads by applying advanced directional piezoelectric actuators, the aircraft rudder, switch

mode amplifiers, and advanced control strategies on an F/A-18 aircraft empennage. Some results of the full-scale investigation are presented herein.
Author
Active Control; Buffeting; Excitation; F-18 Aircraft; Control Systems Design

20050192588 Research and Technology Organization, Neuilly-sur-Seine, France
Modelling and Simulation to Address NATO's New and Existing Military Requirements
October 2004; 272 pp.; In English; NATO RTO Modelling and Simulation Conference, 7-8 Oct. 2004, Koblenz, Germany; See also 20050192589 - 20050192610
Report No.(s): RTO-MP-MSG-028; AC/323(MSG-028)TP/15; Copyright; Avail: CASI; C01, CD-ROM; A12, Hardcopy

NATO is in the process of radical change through the NATO Transformation process and the development of new military requirements without neglected the existing ones. From a broad NATO perspective, the emphasis is on collaborative efforts to improve joint, combined capabilities. Two strategic commands, one operational (Allied Command Operations, ACO, located in Brussels, Belgium), and one functional (Allied Command Transformation, ACT, located in Norfolk, Virginia, USA) have been recently established. The second, functional strategic command ACT is responsible for the continuing transformation of military capabilities and for promoting interoperability of proposed implementations. Modelling and Simulation (M&S) has been recognized within NATO as a key element in addressing these new requirements and challenges of the NATO Transformation process. This year s conference was planned to focus on the ways in which Modelling and Simulation can address these new requirements and challenges and assist in the NATO Transformation process without neglecting the existing military requirements. To this end, the conference was designed to provide attendees a forum to advance M&S in the Alliance. The combination of M&S users and developers concentrated in this one forum educated attendees, and also provided fresh ideas for the furtherance of NATO M&S in addressing NATO s New and Existing Military Requirements.
Derived from text
Interoperability; Simulation; Military Operations; User Requirements

20050192646 NASA Langley Research Center, Hampton, VA, USA
Latency in Visionic Systems: Test Methods and Requirements
Bailey, Randall E.; Arthur, J. J., III; Williams, Steven P.; Kramer, Lynda J.; [2005]; 14 pp.; In English; Workshop on Toward Recommended Methods for Testing and Evaluation of EV and ESV Based Visionic Devices, 26-27 Apr. 2005, Williamsburg, VA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-079-60-10; No Copyright; Avail: CASI; A03, Hardcopy

A visionics device creates a pictorial representation of the external scene for the pilot. The ultimate objective of these systems may be to electronically generate a form of Visual Meteorological Conditions (VMC) to eliminate weather or time-of-day as an operational constraint and provide enhancement over actual visual conditions where eye-limiting resolution may be a limiting factor. Empirical evidence has shown that the total system delays or latencies including the imaging sensors and display systems, can critically degrade their utility, usability, and acceptability. Definitions and measurement techniques are offered herein as common test and evaluation methods for latency testing in visionics device applications. Based upon available data, very different latency requirements are indicated based upon the piloting task, the role in which the visionics device is used in this task, and the characteristics of the visionics cockpit display device including its resolution, field-of-regard, and field-of-view. The least stringent latency requirements will involve Head-Up Display (HUD) applications, where the visionics imagery provides situational information as a supplement to symbology guidance and command information. Conversely, the visionics system latency requirement for a large field-of-view Head-Worn Display application, providing a Virtual-VMC capability from which the pilot will derive visual guidance, will be the most stringent, having a value as low as 20 msec.
Author
Weather; Imaging Techniques; Technology Utilization; Time Lag; Enhanced Vision; Avionics; Head-Up Displays

20050196647 Research and Technology Organization, Neuilly-sur-Seine, France
Personal Hearing Protection including Active Noise Reduction
June 2005; 114 pp.; In English; Personal Hearing Protection Including Active Noise Reduction, 25-26 Oct. 2004, Warsaw, Poland; See also 20050196648 - 20050196652
Report No.(s): RTO-EN-HFM-111; AC/323(HFM-111)TP/56; Copyright; Avail: CASI; C01, CD-ROM; A06, Hardcopy

Personal hearing protection and speech communication facilities are essential for optimal performance in military operations. High noise levels increase the risk of noise induced hearing loss and deterioration of communications. These proceedings from a lecture series on hearing protection and speech communication discuss the state-of-the-art of these topics. This includes: 1) The physiological effects in the ear due to a high noise exposure and criteria for an adequate protection; 2) The construction and performance of passive hearing protectors (isolation of noise); 3) Active hearing protectors (electronic generation of anti noise); 4) Optimal design or selection of systems by various assessment methods; and 5) Realistic examples of military applications. The lecture series were held in Poland, Belgium, and the USA.
Author (revised)
Active Control; Ear; Ear Protectors; Noise Reduction; Human Factors Engineering

20050199511 NASA Langley Research Center, Hampton, VA, USA
Virtual Laboratory Enabling Collaborative Research in Applied Vehicle Technologies
Lamar, John E.; Cronin, Catherine K.; Scott, Laura E.; [2005]; 18 pp.; In English; RTO/AVT-123 Symposium on Flow Induced Unsteady Loads and the Impact on Military Applications, 25-29 Apr. 2005, Budapest, Hungary; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-090-50-70
Report No.(s): RTO-MP-AVT-123; No Copyright; Avail: CASI; A03, Hardcopy
The virtual laboratory is a new technology, based on the internet, that has had wide usage in a variety of technical fields because of its inherent ability to allow many users to participate simultaneously in instruction (education) or in the collaborative study of a common problem (real-world application). The leadership in the Applied Vehicle Technology panel has encouraged the utilization of this technology in its task groups for some time and its parent organization, the Research and Technology Agency, has done the same for its own administrative use. This paper outlines the application of the virtual laboratory to those fields important to applied vehicle technologies, gives the status of the effort, and identifies the benefit it can have on collaborative research. The latter is done, in part, through a specific example, i.e. the experience of one task group.
Author
Research Vehicles; Leadership; Management Systems

20050199656 NASA Langley Research Center, Hampton, VA, USA
A Method to Analyze Tail Buffet Loads of Aircraft
Pototzky, Anthony S.; Moses, Robert W.; [2005]; 14 pp.; In English; RTO/AVT-123: Symposium on Flow Induced Unsteady Loads and the Impact on Military Applications, 25-29 Apr. 2005, Budapest, Hungary; Original contains color illustrations
Contract(s)/Grant(s): 23-745-45-43
Report No.(s): RTO-MP-AVT-123; Paper 19-1; No Copyright; Avail: CASI; A03, Hardcopy
Aircraft designers commit significant resources to the design of aircraft in meeting performance goals. Despite fulfilling traditional design requirements, many fighter aircraft have encountered buffet loads when demonstrating their high angle-of-attack maneuver capabilities. As a result, during test or initial production phases of fighter development programs, many new designs are impacted, usually in a detrimental way, by resulting in reassessing designs or limiting full mission capability. These troublesome experiences usually stem from overlooking or completely ignoring the effects of buffet during the design phase of aircraft. Perhaps additional requirements are necessary that addresses effects of buffet in achieving best aircraft performance in fulfilling mission goals. This paper describes a reliable, fairly simple, but quite general buffet loads analysis method to use in the initial design phases of fighter-aircraft development. The method is very similar to the random gust load analysis that is now commonly available in a commercial code, which this analysis capability is based, with some key modifications. The paper describes the theory and the implementation of the methodology. The method is demonstrated on a JSF prototype example problem. The demonstration also serves as a validation of the method, since, in the paper, the analysis is shown to nearly match the flight data. In addition, the paper demonstrates how the analysis method can be used to assess candidate design concepts in determining a satisfactory final aircraft configuration.
Author
Gust Loads; Buffeting; Fighter Aircraft; Aircraft Design; Angle of Attack; Random Loads

20050199707 NASA Langley Research Center, Hampton, VA, USA

Particle Image Velocimetry Measurements to Evaluate the Effectiveness of Deck-Edge Columnar Vortex Generators on Aircraft Carriers

Landman, Drew; Lamar, John E.; Swift, Russell; [2005]; 16 pp.; In English; RTO/AVT-124 Specialist Meeting on Recent Developments in Non-Intrusive Measurement Technology for Military Application on Model-and FUll-Scale Vehicles, 25-29 Apr. 2005, Budapest, Hungary

Contract(s)/Grant(s): 23-090-50-70

Report No.(s): RTO-MP-AVT-124; Paper 7; Copyright; Avail: CASI; A03, Hardcopy

Candidate passive flow control devices were chosen from a NASA flow visualization study to investigate their effectiveness at improving flow quality over a flat-top carrier model. Flow over the deck was analyzed using a particle image velocimeter and a 1/120th scaled carrier model in a low-speed wind tunnel. Baseline (no devices) flow quality was compared to flow quality from combinations of bow and deck-edge devices at both zero and 20 degrees yaw. Devices included plain flaps and spiral cross-section columnar vortex generators attached in various combinations to the front and sides of the deck. Centerline and cross plane measurements were made with velocity and average turbulence measurements reported. Results show that the bow/deck-edge flap and bow/deck-edge columnar vortex generator pairs reduce flight deck turbulence both at zero yaw and at 20 degrees yaw by a factor of approximately 20. Of the devices tested, the most effective bow-only device appears to be the plain flap.

Author

Particle Image Velocimetry; Vortex Generators; Computational Fluid Dynamics; Aircraft Carriers; Low Speed Wind Tunnels; Aircraft Compartments

20050209967 Research and Technology Organization, Neuilly-sur-Seine, France

Introduction to Flight Test Engineering, Volume 14

Stoliker, Fred N.; July 2005; 456 pp.; In English; See also 20050209968 - 20050210000

Report No.(s): RTO-AG-300-Vol-14; AC/323(SCI-FT3)TP/74-Vol-14; Copyright; Avail: CASI; C01, CD-ROM; A20, Hardcopy

Flight test is at the core of what organizations must do in order to validate the operation and systems on an aircraft. While the AGARDograph series 300 and 160 series deal with aspects of this testing, this volume pulls it all together as an introduction to the process required to do effective flight test engineering. This volume was originally published in 1995. Its utility has been proven in that many flight test organizations and universities have requested copies for their engineers and students. It was felt that re-issuing it in a new format designed for electronic publication would be valuable to the community. This second printing changes none of the text, but rather reformats it. All the original references to AGARD (instead of RTO) are left in place so that none of the flavor of the original publication is lost. This is the Introductory Volume to the Flight Test Techniques Series. It is a general introduction to the various activities and aspects of Flight Test Engineering that must be considered when planning, conducting, and reporting a flight test program. Its main intent is to provide a broad overview to the novice engineer or to other people who have a need to interface with specialists within the flight test community. The first two Sections provide some insight into the question of why flight test and give a short history of flight test engineering. Sections 3 through 10 deal with the preparation for flight testing. They provide guidance on the preliminary factors that must be considered; the composition of the test team; the logistic support requirements; the instrumentation and data processing requirements; the flight test plan; the associated preliminary ground tests; and last, but by no means least, discuss safety aspects. Sections 11 through 27 describe the various types of flight tests that are usually conducted during the development and certification of a new or modified aircraft type. Each Section offers a brief introduction to the topic under consideration, and the nature and the objectives of the tests to be conducted. It lists the test instrumentation (and, where appropriate, other test equipment and facilities) required, describes the test maneuvers to be executed, and indicates the way in which the test data is selected, analyzed, and presented. The various activities that should take place between test flights are presented next. Items that are covered are: who to debrief; what type of reports to send where: types of data analysis required for next flight; review of test data to make a comparison to predicted data and some courses of action if there is not good agreement; and comments on selecting the next test flight. The activities that must take place upon completion of the test program are presented. The

types of reports and briefings that should take place and a discussion of some of the uses of the flight test data are covered. A brief forecast is presented of where present trends may be leading.
Author
Flight Tests; Data Processing; Ground Tests

20050215585 Research and Technology Organization, Neuilly-sur-Seine, France
Pathological Aspects and Associated Biodynamics in Aircraft Accident Investigation
August 2005; 86 pp.; In English; Pathological Aspects and Associated Biodynamics in Aircraft Accident Investigation, 28-29 Oct. 2004, Madrid, Spain; See also 20050215586 - 20050215594
Report No.(s): RTO-EN-HFM-113; AC/323(HFM-113)TP/57; Copyright; Avail: CASI; C01, CD-ROM; A05, Hardcopy

Associated Biodynamics in Aircraft Accident Investigation , to review the status and future directions related to effective crashworthiness design and design criteria of aircraft and how such new design interfaces with some critical aspects of the aircraft accident investigation preferably those related to forensic pathology, biodynamics of injury, injury mechanism, injury mitigation and their implications for flight safety in relation to any type air based platform. These Lecture Series (LS) will be focused on determining what injury and injury mechanism data are required from accident investigations and will make recommendations on effective techniques and methodologies to use in the conduct of an accident investigation. The purpose of this LS is to address the above mentioned critical aspects of the investigation and discuss specific issues such: 1) Determine service and country aircraft accident and ejection data requirements (injuries, equipment failure, etc...). Focus on determining what injury and injury mechanism data are required by service and by country and determine what data are not universally acquired, or not acquired at all, but deemed essential. 2) Acquire crash and survivability data on non aircraft accidents. Focus on general data, automobile crash data and correlation of measurements in anthropometric dummies to injury risk (predictive modelling of human tolerance levels), crashworthiness of vehicles and equipment and survivability of accidents, that may be useful in determination of injury mechanisms, survivability and development of crashworthiness design criteria. 3) Determine what appropriate injury criteria are available and how those criteria can be measured and analysed during testing of aircraft personnel. 4) Provide recommendations on effective accident investigation techniques and methodologies for obtaining accurate and sufficient injury data from aircraft crashes and ejection. Recommendations should enhance ability to determine injury mechanism from aircraft accidents and to prevent injuries. This LS, sponsored by the Human Factor and Medicine Panel has been implemented by the Consultant and Exchange Programme. Thanks for the collaboration and magnificent support given for the Spanish authorities in providing the necessary facilities in Madrid to conduct this Lecture Series, and LS speakers for providing the related academic technical and scientific information.
Author
Accident Investigation; Biodynamics; Crashworthiness; Data Processing Equipment; Flight Safety