Low Speed Wind Tunnel Testing

Low-speed wind tunnel tests were conducted to determine the subsonic aerodynamic characteristics of an optimized supersonic (Mach 6) conical-flow waverider designed for a deck-launched intercept mission. These tests are part of the continuing waverider research being conducted by the Naval Postgraduate School and the NASA Ames Research Center. The tests consisted of performing Alpha and Beta sweeps, at different dynamic pressures, with a 15 inch aluminum waverider model in the NPS low-speed wind tunnel. Force and moment data were then collected using a six-degree-of-freedom sting balance. Coefficients of lift, drag and pitch were calculated from the data and compared to theory and existing waverider subsonic aerodynamic performance data. Flow visualization using tufts was also done. The results of the experiments show that waverider exhibits high lift characteristics at positive angles of attack. The design also compares favorably with both subsonic thin airfoil theory and the results of the delta wing and subsonic waverider analysis done by Vanhoy. However, flow visualization showed that vortex bursting occurred at a dynamic pressure of 12. llbf at +/-15 degrees angle of attack. Based upon the data collected in this analysis, the development of an actual waverider aircraft using the NPS/NASA ames waverider design as a baseline is a plausible endeavor.

The book "Wind Tunnels and Experimental Fluid Dynamics Research" is comprised of 33 chapters divided in five sections. The first 12 chapters discuss wind tunnel facilities and experiments in incompressible flow, while the next seven chapters deal with building dynamics, flow control and fluid mechanics. Third section of the book is dedicated to chapters discussing aerodynamic field measurements and real full scale analysis (chapters 20-22). Chapters in the last two sections deal with turbulent structure analysis (chapters 23-25) and wind tunnels in compressible flow (chapters 26-33). Contributions from a large number of international experts make this publication a highly valuable resource in wind tunnels and fluid dynamics field of research.

High Speed Wind Tunnels

Low Speed Wind Tunnel Testing of a Laser Propelled Vehicle

Design, Construction, and Testing of an Open-loop Low-speed Wind Tunnel

Analysis of a Split-Plot Experimental Design Applied to a Low-Speed Wind Tunnel Investigation

This thesis describes the development and assessment of an undergraduate wind tunnel test engineering course utilizing the 7ft by 10ft Oran W. Nicks Low Speed Wind Tunnel (LSWT). Only 5 other universities in the United States have a wind tunnel of similar size and none have an undergraduate wind tunnel test engineering course built around it. Many universities use smaller wind tunnels for laboratory instruction, but these experiments are meant to only demonstrate basic concepts. Students go beyond conceptual learning in this wind tunnel test engineering course and conduct real-world experiments in the LSWT. This course puts knowledge into practice and further prepares students whether continuing on to graduate school or industry. Course content mainly originates from the chapters in Low Speed Wind Tunnel Testing by Barlow, Rae, and Pope. This is the most comprehensive book that addresses the specific requirements of large scale, low speed wind tunnel testing. It is not a textbook for novices. The three experiments used in the course are modeled on actual experiments that were performed at the LSWT. They are exactly what a commercial entity would want performed although the time scale is drastically reduced because of class requirements. Students complete the course with a working knowledge of the requirements of large scale, low speed wind tunnel tests because they have successfully performed real-world tests and have performed data reduction that is needed for high-quality industrial tests. The electronic version of this dissertation is accessible from http://hdl.handle.net/1969.1/149345

A brand-new edition of the classic guide on low-speed wind tunnel testing While great advances in theoretical and computational methods have been made in recent years, low-speed wind tunnel testing remains essential for obtaining the full range of data needed to guide detailed design decisions for many practical engineering problems. This long-awaited Third Edition of William H. Rae, Jr.'s landmark reference brings together essential information on all aspects of low-speed wind tunnel design, analysis, testing, and instrumentation in one easy-to-use resource. Written by authors who are among the most respected wind tunnel engineers in the world, this edition has been updated to address current topics and applications, and includes coverage of digital electronics, new instrumentation, video and photographic methods, pressure-sensitive paint, and liquid crystal-based measurement methods. The book is organized for quick access to topics of interest, and examines basic test techniques and objectives of modeling and testing aircraft designs in low-speed wind tunnels, as well as applications to fluid motion analysis, automobiles, marine vessels, buildings, bridges, and other structures subject to wind loading. Supplemented with real-world examples throughout, Low-Speed Wind Tunnel Testing, Third Edition is an indispensable resource for aerospace engineering students and professionals, engineers and researchers in the automotive industries, wind tunnel designers, architects, and others who need to get the most from low-speed wind tunnel technology and experiments in their work.

Aeroacoustic Measurements

Low-speed Wind-tunnel Tests on a Series of Uncambered Slender Pointed Wings with Sharp Edges

Self Streamlining Wind Tunnel: Further Low Speed Testing and Final Design Studies for the Transonic Facility

Low Speed Wind Tunnel Testing Facility Requirements

This volume contains the papers of a German symposium dealing with research and project work in numerical and experimental aerodynamics and fluidmechanics for aerospace and other applications. It gives a broad overview over the ongoing work in this field in Germany.

New edition of the successful textbook updated to include new material on UAVs, design guidelines in aircraft engine component systems and additional end of chapter problems Aircraft Propulsion, Second Edition follows the successful first edition textbook with comprehensive treatment of the subjects in airbreathing propulsion, from the basic principles to more advanced treatments in engine components and system integration. This new edition has been extensively updated to include a number of new and important topics. A chapter is now included on General Aviation and Uninhabited Aerial Vehicle (UAV) Propulsion Systems that includes a discussion on electric and hybrid propulsion. Propeller theory is added to the presentation of turboprop engines. A new section in cycle analysis treats Ultra-High Bypass (UHB) and Geared Turbofan engines. New material on drop-in biofuels and design for sustainability is added to refl ect the FAA's 2025 Vision. In addition, the design guidelines in aircraft engine components are expanded to make the book user friendly for engine designers. Extensive review material and derivations are included to help the reader navigate through the subject with ease. Key features: General Aviation and UAV Propulsion Systems are presented in a new chapter Discusses Ultra-High Bypass and Geared Turbofan engines Presents alternative drop-in jet fuels Expands on engine components' design guidelines The end-of-chapter problem sets have been increased by nearly 50% and solutions are available on a companion website Presents a new section on engine performance testing and instrumentation Includes a new 10-Minute Quiz appendix (with 45 quizzes) that can be used as a continuous assessment and improvement tool in teaching/learning propulsion principles and concepts Includes a new appendix on Rules of Thumb and Trends in aircraft propulsion Aircraft Propulsion, Second Edition is a must-have textbook for graduate and undergraduate students, and is also an excellent source of information for researchers and practitioners in the aerospace and power industry.

NASA Langley Low Speed Aeroacoustic Wind Tunnel

Forward Swept Wing Study - Phase 1B Low-Speed Wind Tunnel Testing

Low-Speed Wind Tunnel Testing

Low-speed Wind Tunnel Testing of a Mach 6 Viscous Optimized Waverider

The NASA Langley Research Center Low Speed Aeroacoustic Wind Tunnel is a premier facility for model-scale testing of jet noise reduction concepts at realistic flow conditions. However, flow inside the open jet test section is less than optimum. A Construction of Facilities project, scheduled for FY 05, will replace the flow collector with a new design intended to reduce recirculation in the open jet test section. The reduction of recirculation will reduce background noise levels measured by a microphone array impinged by the recirculation flow and will improve flow characteristics in the open jet tunnel flow. In order to assess the degree to which this modification is successful, background noise levels and tunnel flow are documented, in order to establish a baseline, in this report.Booth, Earl R., Jr. and Henderson, Brenda S.Langley Research CenterAEROACOUSTICS; LOW SPEED WIND TUNNELS; WIND TUNNEL TESTS; JET AIRCRAFT NOISE; NASA PROGRAMS; BACKGROUND NOISE; TEST FACILITIES; NOISE INTENSITY; NOISE REDUCTION; FLOW CHARACTERISTICS; MICROPHONES; DATA PROCESSING; ACOUSTIC MEASUREMENT; JET FLOW

The report contains eight papers dealing with design and operation of low-speed wind tunnels for V/STOL testing, constraint corrections in transonic wind tunnels, interference effects of model support systems unsteady measurements in wind tunnels, considerations of dynamic testing, helicopter testing, noise measurements and use of model engines.

Wind Tunnels and Experimental Fluid Dynamics Research

Background Noise and Flow Survey Results Prior to Fy05 Construction of Facilities Modifications

Low-speed Wind Tunnel Testing of the NPS/NASA Ames Mach 6 Optimized Waverider

High-speed Wind Tunnel Testing

A procedure to analyze a split-plot experimental design featuring two input factors, two levels of randomization, and two error structures in a low-speed wind tunnel investigation of a small-scale model of a fighter airplane configuration is described in this report. Standard commercially-available statistical software was used to analyze the test results obtained in a randomization-restricted environment often encountered in wind tunnel testing. The input factors were differential horizontal stabilizer incidence and the angle of attack. The response variables were the aerodynamic coefficients of lift, drag, and pitching moment. Using split-plot terminology, the whole plot, or difficult-to-change, factor was the differential horizontal stabilizer incidence, and the subplot, or easy-to-change, factor was the angle of attack. The whole plot and subplot factors were both tested at three levels. Degrees of freedom for the whole plot error were provided by replication in the form of three blocks, or replicates, which were intended to simulate three consecutive days of wind tunnel facility operation. The analysis was conducted in three stages, which yielded the estimated mean squares, multiple regression function coefficients, and corresponding tests of significance for all individual terms at the whole plot and subplot levels for the three aerodynamic response variables. The estimated regression functions included main effects and two-factor interaction for the lift coefficient, main effects, two-factor interaction, and quadratic effects for the drag coefficient, and only main effects for the pitching moment coefficient. Erickson, Gary E. Langley Research Center NASA/TM-2013-218013, NF1676L-12426, L-20005

Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database.

Main Features of Warton 2.7 X 2.1m Low Speed Wind Tunnel

Wind Tunnel Testing of High-Rise Buildings

Aircraft Propulsion

The Design, Construction and Preliminary Testing of a Low Speed Wind Tunnel Suitable for Transpiration Cooling

Since the 1960s, wind tunnel testing has become a commonly used tool in the design of tall buildings. It was pioneered, in large part, during the design of the World Trade Center Towers in New York. Since those early days of wind engineering, wind tunnel testing techniques have developed in sophistication, but these techniques are not widely understood by the designers using the results. As a direct result, the CTBUH Wind Engineering Working Group was formed to develop a concise guide for the non-specialist. The primary goal of this guide is to provide an overview of the wind tunnel testing process for design professionals. This knowledge allows readers to ask the correct questions of their wind engineering consultants throughout the design process. This is not an in-depth guide to the technical intricacies of wind tunnel testing, it focusses instead on the information the design community needs, including: a unique methodology for the presentation of wind tunnel results to allow straightforward comparison of results from different wind tunnel laboratories. advice on when a tall building is likely to be sufficiently sensitive to wind effects to benefit from a wind tunnel test background for assessing whether design codes and standards are applicable details of the types of tests that are commonly conducted descriptions of the fundamentals of wind climate and the interaction of wind and tall buildings This unique book is an essential guide for all designers of tall buildings, and anyone else interested in the process of wind tunnel testing for tall buildings.

Wind tunnel tests of the 0.09-scale D634-20G FSW fighter model were conducted to obtain low speed longitudinal and lateral-directional stability and control characteristics to substantiate the aerodynamic design features of the configuration. The tests were performed at Mach number 0.23 through angles of attack up to 40 deg in the NAAL tunnel. The effectiveness of the lifting surface design twists and cambers were investigated. The all-moveable canard and wing trailing edge control surface effectiveness were evaluated. Lateral-directional tests included build-ups to evaluate the centerline vertical tail. Wing pressures were measured on the upper and lower surfaces and canard pressures on the upper surface at selected stations. (Author).

The Suitability of CFC-502 for Low Speed Wind Tunnel Testing at High Lift

Summary of Low Speed Airfoil Data

Technical Abstract Bulletin

Scientific and Technical Aerospace Reports

The report presents the results from wind tunnel tests of a one-eighth scale conventional model of the U.S. Army XV-5A Lift Fan Flight Research Aircraft. Volume II presents hinge moment coefficients and pressure data in plotted and tabular form with pertinent detail explanatory information. Pressure and hinge moment data were not recorded during the second phase of the low speed testing. (Author).

The book describes recent developments in aeroacoustic measurements in wind tunnels and the interpretation of the resulting data. The reader will find the latest measurement techniques described along with examples of the results.

Wind Tunnel Test Report Conventional Model. Volume Ii. Low Speed Pressure and Hinge Moments

New Results in Numerical and Experimental Fluid Mechanics III

Low Speed Wind Tunnel for Heat Exchanger Testing

Low-speed wind tunnel testing. [With illustrations.].

An analysis of selected portions of the data resulting from a low speed wind tunnel test of a semi-span model of a VTOL aircraft is presented. The model features an integrated propulsion/lifting surface system as well as a horizontal tail located on an aft, wing tip extension. The propulsion system flow, simulated with cold air, exhausts over the wing trailing edge flap (flap jet) and out of the lower surface of the wing (wing box jet). The exhaust flows can be independently vectored through 90 degrees. Force and moment data are presented for both static and forward flight conditions. Some comparison with theoretical predictions are presented. Portions of the data are shown with the direct thrust components removed. The results of this analysis show that: (1) the outboard location of the horizontal tail provides a reduction in airplane induced drag, (2) a significant portion of the theoretical jet flap effect is obtained with the wing box jet directed parallel to the wing chord plane, (3) a reduced jet flap effect is available with deflections of the wing box jet away from the wing chord plane, and (4) further testing is desirable for a better understanding of the characteristics of this configuration. (Author).

An open-loop low-speed wind tunnel is one of the easiest ways to study about aerodynamics for undergraduate studies. The objectives of this project are to propose a design with detail analysis, fabrication of a small scale open-loop low-speed wind tunnel and to validate the designed wind tunnel through performance testing with the existing instrumentations available in the laboratory. The wind tunnel was designed by considering the essential parts of the wind tunnel with the proper justifications before modelled with Computer Aided Design (CAD) and then tested using the Computational Fluid Dynamics (CFD). After obtaining the desired simulation result, the designed wind tunnel was fabricated and then followed by the test models. Then the wind tunnel undergoes the performance testing for validation and calibration. For the Ahmed Body flow pattern testing, the flow behaves just like the flow pattern tested in calibrated wind tunnel. For the case study testing, a cylinder model was used and the highest flow speed is 0.4317 m/s while the slowest flow speed is 0.1401 m/s. However for the case study experiment, the result obtained is not at its best condition as there is wake flow generated around the cylinder body and further improvement is required to obtain the undoubtedly results.

Low Speed Wind Tunnel Testing and Data Correction Methods for Aircraft Models in Ground Effect

Laser Velocimetry in the Low-speed Wind Tunnels at Ames Research Center

Problems in Wind Tunnel Testing Techniques

Self Streamlining Wind Tunnel: Low Speed Testing and Transonic Test Section Design

The wind tunnel is the most fundamental test equipment for aircraft testing and studying aerodynamics. Because of the complexity of the test-subject's geometry, it is difficult to study the aerodynamic pattern simply based on theoretical calculations. Most of the aerodynamics experiments still use wind tunnels. The progress of the wind tunnel is highly related to the advancements in air crafts. Aircraft manufacturing has pushed the wind tunnel technology forward. Wind tunnels can be categorized by the wind speed limit differences, which are controlled by the mechanism of the driving methods, structure applications, etc. In this case, we built a small scale wood based wind tunnel for future testing of "Magnetic Augmented Rotational System (MARS)". This thesis discusses the low speed wind tunnel, subsonic wind tunnel, transonic wind tunnel, supersonic wind tunnel, hypersonic wind tunnel, high enthalpy hypersonic wind tunnel, and puts the focus on low speed wind tunnel. The characteristics of the low speed wind tunnel and the related data will be presented along with its advantages and shortcomings.

The proposed will be the fourth edition of a classic text reference originally authored by William H. Rae Jr. The book is considered one of the only availabel which covers all aspects of wind low-speed tunnel design, analysis, testing, and instrumentation. The authors are considered the most experienced wind tunnel engineers in the world and manage the University of Maryland's Glenn L. Martin Wind Tunnel. This edition has been updated with a new chapter on experiments on insects and other flying animals, as well as discussion throughout about the relationship between wind tunnel testing and Computational Fluid Dynamics or CFD. There will also be updates to third edition topics and applications, including coverage of digital electronics, new instrumentation, video and photographic methods, pressure-sensitive paint, and liquid crystal-based measurement methods. As with prior editions the book will be supplemented with real-world examples based on the authors' work. It is planned that this edition will be supplemented with an online resource containing software applications and simulations using MATLAB or other commercial programs that will enhance its use in both academic and professional markets.

5.5m Low Speed Wind Tunnel

Developing a Practical Wind Tunnel Test Engineering Course for Undergraduate Aerospace Engineering Students

A Customer's Perspective

Design, Construction and Characterization of a Wind Tunnel