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Recommended Practice

Wind Tunnel Testing – Part II: Practitioners Volume

Sponsor

American Institute of Aeronautics and Astronautics

Approved

Abstract

This recommended practice document is the second part of a two-part series intended to provide test project management and practitioners with best practices that will maximize data value of wind tunnel test projects. Part I is designed to help managers understand the impact of decision making before and during development of a test project and provides key activities to help improve the timeliness and cost-effectiveness of future wind tunnel test projects. Part II provides those responsible for test execution with best practices to employ when preparing for and implementing tests.

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Foreword

The American Institute of Aeronautics and Astronautics (AIAA) Ground Test Technical Committee (GTTC) began looking at best practices associated with test article development as a way to recommend improvements in wind tunnel test efficiency, cost, and cycle time. Early on, it became apparent to the participants of the AIAA working group that trying to separate test article development from overall wind tunnel test process was not a productive and useful activity. The highly integrated nature of the processes, organizations, and personnel involved in wind tunnel test projects require that a broader viewpoint of the wind tunnel test process be evaluated in order to develop successful techniques and methods. The two-part effort, "Recommended Practices for Wind Tunnel Testing," is the result of that evaluation.

Part I was written to provide managers with clear insight into achieving technically focused, cost-efficient, low-risk test programs (which contain multiple test projects) that support the development of aerodynamic vehicles and technologies. This recommended-practices document will help managers understand the impact of decision making before and during the development of a test program and will provide key activities to help improve quality, timeliness, and cost-effectiveness of wind tunnel test projects.

Part II provides additional detail on successful methods for those directly involved in developing and executing individual tests.

Neither volume is intended to be a totally comprehensive document on successful wind tunnel testing. Instead, they represent a compilation of best practices to provide a strong foundation for the successful development of a test program or test effort. While these practices focus on wind tunnel test processes, the information is applicable to many other ground test activities.

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The skill and leadership of Mr. Cap Catalanotto was critical to the early activities of this work group. Many others also contributed to this document during its development.

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On the recommendation of the Test Processes Working Group, the following knowledgeable individuals reviewed this document and provided valuable critiques. Approval of the document was unanimous.

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The AIAA Ground Test Technical Committee (GTTC), Mr. Allen Arrington, Chairman, approved this document in July 2002.

The AIAA Standards Executive Council (Donald Cromer, Chairman) approved this document in September, 2003.

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1 Introduction

The purpose of this recommended practice document is to provide the reader with increased knowledge about planning and executing highly successful wind tunnel tests. First, an overview of the test process is provided, giving a general picture of the origin, purpose, and high-level breakdown of activities that are a part of wind tunnel test development and execution. Secondly, detail is added to the overview to define the full scope of the activities and key considerations. Finally, recommended practices and lessons learned are described.

Part I of this recommended practice looked at test development from a management perspective. This volume (Part II) will provide additional detail that is more useful to participants who develop and execute testing activities. Part II is organized into sections describing activities and best practices during the various stages of test implementation:

- Program development
- Pretest planning and preparation
- Model development and fabrication
- Pretest buildup and preparation
- Testing
- Post-test activities

Part II of this recommended practice document was assembled with guidance from experts (both industry and government) who are responsible for all aspects of wind tunnel testing. Experts from airframe companies (military and commercial), as well as model makers and tunnel operators contributed best practices to help guide test personnel through the implementation and execution of a test project.

2 Aircraft Program Development

Aircraft designs continually push the state-of-the-art in technology. Advances in materials, instrumentation, and onboard computing will continue to allow the design of higher performance, lighter weight aircraft. Consequently, wind tunnel testing has become more sophisticated as demands for improved aircraft performance have increased. Relatively simple aerodynamic tests of early years have broadened to highly specialized testing. Advances in wind tunnel test facilities and techniques are also impacting testing projects by reducing cycle times and increasing the amount, quality, and versatility of the data collected.

As test requirements flow from a programmatic level to the finer detail of individual tests, activities and issues associated with the requirements are developed and refined to enable the completion of individual tests. It is often during this flow down that the success or failure of a test effort is determined.

2.1 Overview

As used in this document, an aircraft development **program** refers to the process by which a new aircraft or major derivative is created—from initial concept to production. The test **project** is the portion of the development program when testing is conducted. For this document, the test project will focus on a wind tunnel testing activity. Therefore, each test project is an integrated and important part of the entire vehicle development program.

The phase of a development program has direct bearing on the level of technical requirements for the individual test project. Traditionally, aircraft or technology development programs generally follow three phases: