

# Nomenclature and Axis Systems for Aerodynamic Wind Tunnel Testing

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## Guide

# Nomenclature and Axis Systems for Aerodynamic Wind Tunnel Testing

### Sponsored by

American Institute of Aeronautics and Astronautics

Approved March 2012

### Abstract

This guide is intended to increase the understanding of test nomenclature and axis systems between wind tunnel facilities throughout the world. Facilities should consider fully adopting the nomenclature in this Guide. At a minimum, it is recommended that this Guide be used as a reference for nomenclature between facilities.

Published by

**American Institute of Aeronautics and Astronautics**  
**1801 Alexander Bell Drive, Reston, VA 20191**

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Printed in the United States of America

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## Foreword

Wind tunnel test data nomenclature may be ambiguous and is quite often a source of confusion between wind tunnel test facilities. Using a parameter incorrectly could result in bad wind tunnel data with damaging consequences.

The Ground Testing Technical Committee (GTTC) of the American Institute of Aeronautics and Astronautics (AIAA) was asked to sponsor a working group on test nomenclature. After approval, the Test Nomenclature Working Group was formed under the operating structure of the GTTC. This nomenclature standard is limited to steady-state wind tunnel testing involving forces and pressures for the broader wind tunnel testing community.

This guide is intended to increase the understanding of test nomenclature and axis systems between wind tunnel facilities throughout the world. Facilities should consider fully adopting the nomenclature in this guide. At a minimum, it is recommended that this nomenclature guide be used as a reference for nomenclature between facilities.

Some of the benefits that may be achieved by using a standard set of nomenclature for testing are

- increased customer understanding
- increased portability of experimental data
- increased usefulness of archived data
- increased workforce flexibility
- reduced data system development and support costs

During the initial meeting, an invitation list was developed for prospective organizations to join the working group representing several wind tunnel facilities, wind tunnel customer organizations, and academia. A standard is more effective when it is accepted at inception by a broad spectrum of participating organizations.

The following officers and members have provided dedicated support, contributions, and leadership to the AIAA/GTTC Test Nomenclature Working Group; their efforts have resulted in the development of this Guide:

David Cahill, Chair	ATA/Arnold Engineering Development Center
Pete Wilcox, Co-Chair	The Boeing Company
Clifford Obara, Secretary	NASA Langley Research Center
Max Amaya	NASA Ames Research Center
Nancy Anderson	Lockheed Martin Space Systems
Allen Arrington	Sierra Lobo Inc., NASA Glenn Research Center
John Henning	Sandia National Laboratories
Frank Jackson	ATA/Arnold Engineering Development Center
Mark Melanson	Lockheed Martin Aeronautics Company
Joe Patrick	Lockheed Martin Aeronautics Company
Juergen Quest	European Transonic Wind Tunnel
Don Saxer	Calspan (now at NASA Langley Research Center)
Nick Verhaagen	Delft University of Technology
Julien Weiss	University of Québec

The following individuals are also acknowledged for their contributions:

Jean Bianco	NASA Headquarters
Guy Kemmerly	NASA Langley Research Center
Frank Kmak	NASA Ames Research Center

In addition, NASA Ames Research Center, the NASA Glenn Research Center, and the Arnold Engineering and Development Center provided their internal nomenclature toward the development of this standard.

The GTTC consensus body approved this document in November 2011. The consensus body submitted this document to the AIAA Standards Executive Council (SEC) for their review in January 2012. The AIAA Standards Executive Council (Wilson Felder, Vice President) accepted the document for publication in March 2012.

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# 1 Scope

This document provides a recommended test nomenclature for steady-state wind tunnel testing involving force, moment, and pressure data. This guide may be used as a translator (Rosetta stone) between different facilities and customers. The use of this document will enhance the understanding and communication between customers and facilities in the wind tunnel testing community.

A major focus throughout this process has been to achieve a balance between too much or too little detail in the nomenclature parameters and definitions. When the names become too long, it is no longer nomenclature, but a full description of the item. The best nomenclature is immediately understood with no need to look it up. It is recognized that for this guide to be fully adopted, it must be easy to use and understand.

## 1.1 Purpose

Test nomenclature ambiguity can be a source of confusion, error, and inefficiency. While wind tunnel facilities measure many of the same physical quantities and apply similar corrections to their data, no two facilities and customers use the same set of nomenclature. This presents difficulties for facilities with multiple customers and customers who test at multiple facilities. This sometimes leads to serious confusion, especially when a variable ends up with the same name but a different meaning. Finally, wind tunnel operation often requires the transfer of staff between facilities, which would be greatly facilitated by common nomenclature at each facility.

## 1.2 Constraints

For each parameter addressed, a standard name is defined for use by data reduction, display, and storage devices. The computer names are limited to four characters with no distinction made between upper and lower case. Only standard letters, numbers, and the underscore character are allowed (no symbols or Greek letters); subscripts and superscripts are not allowed. The meaning, unit of measure, and sign convention are defined for each parameter as well as a recommended name for publication. The standard units for each parameter are defined for the International System, SI, and the English system. Units are not defined for the publication parameters since it is typically done in the publication.

The following groups of testing parameters are included in this recommended nomenclature:

- Test Section Conditions;
- Model Axis Systems and Attitude;
- Dimensional Reference and
- Pressures, Forces, Moments, and their Coefficients.

## 1.3 Naming Convention

The parameter names consist of a base name and a four-character suffix, which provides information about the parameter. The base name is a commonly used, and thus recognizable, name for the specific parameter. The suffix begins with an underscore character to set it apart from the base name.

The remaining three characters begin with an "S" to identify and associate the parameter with this AIAA Wind Tunnel Nomenclature standard. An "X" in this position instead of an "S" indicates that a change was made to the parameter requiring the user to seek further guidance.

The next character in the suffix defines the parameter group. For example, all parameters describing the empty test section flow field have an "F" in this position.

The last character of the parameter name defines the system of units. "I" indicates that the SI convention is used, "E" indicates that English units are presented, and "C" indicates that the parameter is non-dimensional.