

Terrestrial Environment Guidelines for Use in Aerospace Vehicle Development

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Guide

Terrestrial Environment Guidelines for Use in Aerospace Vehicle Development

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Abstract

This document is based on the NASA Terrestrial Environment (Climatic) Criteria Guidelines for Use in Aerospace Vehicle Development and provides guidelines regarding current natural terrestrial environment criteria to be used for the design and development of aerospace vehicles traversing the terrestrial atmosphere. It provides, in one single reference, a comprehensive description of the state-of-the-art of these natural terrestrial environment inputs. This document reflects on aerospace vehicle development experience and consolidates guidelines for natural terrestrial environments that have been utilized in a large number of space vehicle developments.

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Foreword

The NASA Marshall Space Flight Center Natural Environment Branch and its predecessor organizations have been responsible for each update of the NASA Terrestrial Environment (Climatic) Criteria Guidelines document, and subsequently hereafter be referred to as NASDA "TM" in text of this AIAA Guide. This NASA TM and its predecessors goes back more than 50 years to the early 1960s and has been updated many times since then. The last update was in December 2008 (NASA/TM-2008-215633) and replaces all previous editions of the document, with the latest state-of-the-art atmospheric type criteria being presented. It is not just a compilation of atmospheric or weather climatology but rather a statistically developed set of atmospheric criteria guidelines generated especially for use in the design and development of launch and space vehicles. There are other documents containing only weather or climate related values, but not specifically developed for a given launch vehicle with its particular set of requirements. There is one annex to this AIAA Guide document. Due to the great length of the parent NASA TM document, only the first Section of the NASA TM is presented here, along with a complete listing of the entire NASA TM table of contents as Annex A.

The full contents of the entire AIAA Guide comprising the NASA TM's 16 Sections are available at <http://arc.aiaa.org/userimages/ContentEditor/1405349521582/NASA%20Technical%20Report.pdf> (NASA-TM-2008-215633).

At the time of approval, the members of the AIAA Atmospheric and Space Environment Committee on Standards Terrestrial Working Group who prepared this document were:

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The above consensus body approved this document in July 2014.

The AIAA Standards Executive Council (VP-Standards Laura McGill, Chairperson) accepted the document for publication in February 2015.

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1 Scope

This AIAA Guide provides guidelines regarding the current natural terrestrial environment criteria for use in the design and development of aerospace vehicles traversing the terrestrial atmosphere (0–90 km altitude). This Guide specifies and provides, in one single reference, a comprehensive description of the state of the art of these natural terrestrial environment inputs. The contents to be used are based on aerospace vehicle development experiences and consolidated guidelines for natural terrestrial environments that have been utilized in a large number of space vehicle developments.

Aerospace vehicle design criteria guidelines are provided for the following environmental phenomena: winds; atmospheric models and thermodynamic properties; thermal radiation; U.S. and world surface extremes; humidity; precipitation, fog, and icing; cloud phenomena and cloud cover models; atmospheric electricity; atmospheric constituents; aerospace vehicle exhaust and toxic chemical release; tornadoes and hurricanes; geologic hazards; and sea state. Sections 15 and 16 of this AIAA Guide based on the referenced NASA TM include information on mission analysis, prelaunch monitoring, flight evaluation, physical constants, and metric/English unit conversion factors.

2 Tailoring

When viewed from the perspective of a specific vehicle program or project context, the information in this AIAA Guide may be tailored to match the actual requirements of the particular program or project with respect to expected operational launch site(s) for the vehicle. Tailoring of requirements shall be undertaken in consultation with the procuring authority where applicable.

This Guide may be cited in contract, program, and other documents as an applicable reference document. Mandatory requirements are indicated by the word *shall*. Tailoring of this standard for application to a specific program or project shall be approved by the technical authority for that program/project.

NOTE Tailoring is a process by which individual requirements, specifications, standards, and related documents are evaluated and made applicable to a specific program or project by selection and, in some exceptional cases, modification and addition of requirements in the standards.

3 Reference Documents

The following documents contain provisions that, through reference in this text, constitute provisions of this Guide. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this Guide are encouraged to investigate the possibility of applying the most recent editions of the normative documents listed in Section 3.2. For undated references, the latest edition of the normative document referred to applies.

3.1 General

The documents listed in this section contain provisions that constitute requirements of this Guide as cited in the appendices. The latest issuances of cited documents shall be used unless otherwise approved by the assigned Technical Authority.

3.2 Applicable Documents

The following documents are applicable to NASA TM Section 1 only. Each of the other sections has its own set of references.

NASA/TM-2008-215633; Terrestrial Environment (Climatic) Criteria Guidelines for Use in Aerospace Vehicle Development, 2008 Revision (Section 1).