

Standard

Mass Properties Control for Space Systems

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ANSI/AIAA S-120A-2015(2019)

American National Standard

Mass Properties Control for Space Systems

Sponsored by

American Institute of Aeronautics and Astronautics



and International Society of Allied Weight Engineers, Inc.



Approved 14 October 2015

American National Standards Institute

Approved 23 November 2015

Abstract

Mass properties control is a critical aspect of space system development. This standard and International Society of Allied Weight Engineers, Inc., RP A-3, Recommended Practice for Mass Properties Control for Space Systems, together define terminology and establish uniform processes, procedures, and systematic methods for the management, control, monitoring, determination, verification, and documentation of mass properties during the design and development phases of space systems, including modifications to operational systems. This standard and the recommended practice apply to space vehicles, upper stage vehicles, injection stages, payloads, reentry vehicles, launch vehicles, and ballistic vehicles. This standard is intended to convey minimum requirements applicable to space system development, while the recommended practice is intended to be used as a reference for the development of a program-specific, contractually required mass properties control plan.

ISBN 978-1-62410-385-8

Published by
American Institute of Aeronautics and Astronautics
1200 Sunrise Valley Dr, Reston, VA 20191

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Printed in the United States of America

ISBN978-1-62410-385-8

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Foreword

This revision of the Mass Properties Control for Space Systems Standard was developed in response to contractors who noted that there were implicit requirements called out in AIAA S-120-2006 (denoted by the use of the word “shall”) that were not true requirements, thus adding unnecessary costs to contracts. In response, a Mass Properties Engineering (MPE) Committee on Standards (CoS) was formed and voted unanimously to revise the existing standard.

The International Society of Allied Weight Engineers, Inc. (SAWE), a major source of MPE Subject Matter Experts, signed a Memorandum of Understanding to jointly develop both a revised standard and a revised recommended practice with the American Institute of Aeronautics and Astronautics (AIAA) CoS.

The new revisions, designated as AIAA S-120A-2015 and SAWE RP A-3, are intended to fully replace AIAA S-120-2006 and SAWE RP-11C. When a requirement is identified in a subsection of section 5 of this standard, the corresponding recommended practice is described in the same numbered subsection of RP A-3.

This standard is intended to convey the minimally acceptable mass properties requirements for space systems, while the associated SAWE RP A-3, Mass Properties Control for Space Systems, provides guidance for implementation of a program-specific mass properties control plan. Together, the two documents may also be used to establish requirements during preparation of acquisition contracts and program-specific documents.

This standard contains proven methods and lessons learned for effective mass properties control, combines tools necessary for timely evaluation of program mass properties, and enables early decision making regarding possible design changes.

The primary objective of this standard is to provide an effective means for meeting program requirements for space system mass properties control, analysis, verification, data management, and documentation. It is intended to be comprehensive and practical and will be periodically updated to incorporate advances and innovations.

At the time of approval, the members of the AIAA **Mass Properties Engineering Committee on Standards** were:

Geoffrey Beech, Chair	National Aeronautics and Space Administration (NASA) Marshall Space Flight Center
Mark Andraschko	NASA Langley Research Center (LaRC)
Jeffrey Barajas	Northrop Grumman
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Daniel Kwon	Orbital ATK
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John Nakai	The Aerospace Corporation

Clinton Plaisted	A.I. Solutions
Glen Richbourg	Lockheed Martin Space Systems Company
Ricardo Roy	United Launch Alliance
Robert Shishko	Jet Propulsion Laboratory
Paul Weitekamp	SpaceX
David Wolfe	Blue Origin
Robert Zimmerman	Retired

The above consensus body approved this document in June 2015.

The current members of the AIAA CoS wish to thank the following for their contributions to the initial release of this document: Tom Ajluni, Kevin Bee, Geoffrey Beech, Roger Belt, Gerard Drewel, David Finkleman, Michael Froehlich, William Griffiths, Mahantesh Hiremath, Gary Holloway, Roland Holzmann, Quang Lam, Bell Lee, Dean Liensdorf, Ian MacNeil, Thomas McGovern, John Nakai, Geoffrey Weber, Glen Richbourg, Ricardo Roy, Ronald Solomon, Richard Sugiyama, Joseph Vecera, Ernest Wade, Louis Yang, and Robert Zimmerman.

The AIAA Standards Executive Council (Mr. Allen Arrington, Chairman) accepted the document for publication in October 2015.

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Annexes A, B, and C in this document are informative.

1 Scope

This standard defines terminology and establishes uniform processes, procedures, and methods for the management, control, monitoring, determination, verification, and documentation of mass properties during the design and development phases of space systems, including modifications to operational systems. This standard applies to space vehicles (SVs) or spacecraft (SC), upper stage vehicles, injection stages, satellite payloads, reentry vehicles, launch vehicles (LVs), and ballistic vehicles. This standard defines a minimum set of mass properties requirements and is intended for use in developing a program-specific, contractually required mass properties control plan (MPCP). When used in conjunction with the International Society of Allied Weight Engineers, Inc. (SAWE) Recommended Practice RP A-3, the two documents serve as a comprehensive reference for requirements and best practices in the field of space systems mass properties.

2 Tailoring

When viewed from the perspective of a specific program or project context, the requirements defined in this standard may be tailored in a program-specific MPCP. The requirements of this standard are presented as a minimum set, and any changes or removal should be undertaken in consultation with the procuring authority and subject matter experts where applicable. For the purpose of this document, the 'customer' is the organization that sets the allowable mass, and the 'contractor' is the organization responsible for developing the system or sub-system within the allowable mass. For the purposes of this document the term program is used to refer to either a project or program.

NOTE Tailoring is a process by which individual requirements or 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 Applicable Documents

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

SAWE RP A-3	<i>Mass Properties Control for Space Systems</i>
SAWE RP 6	<i>Standard Coordinate Systems for Reporting the Mass Properties of Flight Vehicles</i>
SAWE RP 16	<i>Measurement of Missile and Spacecraft Mass Properties</i>