BY ORDER OF THE COMMANDER

SMC Tailoring SMC-T-002
8 August 2008

Supersedes:
New issue

Air Force Space Command

SPACE AND MISSILE SYSTEMS CENTER TAILORING

TAILORING INSTRUCTIONS FOR AIAA-S-120-2006

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

FOREWORD

1. This tailoring document defines the Government's requirements and expectations for contractor performance in defense system acquisitions and technology developments.

2. This new-issue SMC tailoring comprises the text of The Aerospace Corporation report number TOR-2008(8583)-7560, entitled *Tailoring Instructions for AIAA-S-120-2006*.

3. Beneficial comments (recommendations, changes, additions, deletions, etc.) and any pertinent data that may be of use in improving this document should be forwarded to the following addressee using the Standardization Document Improvement Proposal appearing at the end of this document or by letter:

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SPACE AND MISSILE SYSTEMS CENTER
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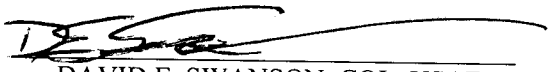
4. This tailoring document has been approved for use on all Space and Missile Systems Center/Air Force Program Executive Office - Space development, acquisition, and sustainment contracts.



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1. Scope

1.1 Purpose

This document shall be used for tailoring the AIAA Standard, S-120-2006 dated 1 December 2006, to provide effective program execution and mission success.

1.2 Application

This document is intended for use in acquisition and study contracts for space systems, and shall be cited in the contract statement of work to specify the mass properties control requirements that are applicable to the acquisition. The AIAA Standard Tailored by this technical operating report (TOR) (hereafter referred to as the "Tailored AIAA Standard") supersedes all revisions of MIL-STD-1811, MIL-HDBK-1811, MIL-M-38310, and TOR-2005(8583)-3970. The AIAA Standard approved on 1 December 2006 shall be tailored by this document as an effective baseline.

The tailored AIAA Standard shall also be used as a compliance document to specify mass properties control requirements for space vehicles, upper-stage vehicles, injection stages, satellite payloads, reentry vehicles, launch vehicles, or ballistic vehicles. When this standard is used as a reference document for these applications, the term "space systems" is to be interpreted as the applicable vehicle.

2. Tailoring

2.1 Definition

A process by which individual requirements from specifications, standards, or related documents are evaluated and applied to a specific program by selection of requirements, or in some exceptional cases, modification or addition of requirements. Tailoring of requirements shall be undertaken in consultation and with approval of the procuring authority where applicable to align the standard with the government's requirements and the mission needs.

This Tailored AIAA Standard establishes a new baseline for requirements, which in turn may be tailored or revised with rationale upon approval by the procuring authority.

2.2 Changes from AIAA S-120-2006

The following is a comprehensive list of the changes that this document imposes on AIAA S-120-2006.

Section	Page	Paragraph	Change Required/Rationale
1	1	Scope	Add paragraph 1.1 "Purpose" to define the relationship between this document and AIAA S-120-2006.
1	1	Scope	Add paragraph 1.2 "Application," which modifies the Scope section of AIAA S-120 and inserts intended use and supersedes the documents.
2	1	Tailoring	Reword definition and add a subsection including this table.
4	5	4.1.2.3 (new)	Add a requirement for generating a mass properties milestone/delivery schedule based on a top-level program schedule.
4	6	4.1.3.2.3	Replace last sentence with "The contractor shall use Table 1, Mass Growth Allowance (MGA) and Depletion Schedule, to determine MGA. The contracting officer may grant… or new technology insertion)."
4	7	Table 1	Include Maturity Code 3 in the major category "E," thus removing maturity code 3 from major category "C." Provides better alignment with historical data.
4	9	Table 2	Change table title to "TPM-Mass Risk Assessment," Change column headings to "Recommended MGA" and "Recommended Predicted Dry Mass Margin." Add a fourth column titled "Basic Dry Mass Margin," which is a sum of columns two and three. Remove color coding for all but the last column. Change notes accordingly. Remove the values associated with the row "SRR" from the table, as there is no supporting data for this program phase.
4	9	4.1.3.2.6.3	Revise the text under 4.1.3.2.6.3 for explanation of revised Table 2 color coding.
4	10	Figure 2	Remove the line and values associated with the heading, "SRR" from the graph (system requirements review).
4	14	4.2.2	Insert at the beginning of the last paragraph: "During the early phases of the program… in the following categories: new, modified, or existing."
4	14	4.2.3.1	Change "shall consider" to "shall include" to emphasize the requirement to include all mass properties parameters in analysis and reporting tasks.
4	15	4.2.3.4 (new)	Add a paragraph, "Heritage of Hardware" to broadly classify new, modified, or existing hardware.
4	18	4.2.5.4.6	Expand Breakup Analysis/Disposal subsection to include detailed information on components to be considered in the analysis.
4	22	4.3.4.4	Change first bullet from "…simulate the flight condition to the extent practical" to "…simulate the dry flight condition and be at least 90% complete by mass, excluding hazardous components or components not normally installed at the measurement site."
4	25	4.5.1	After last sentence, add "A preliminary mass properties control plan shall be submitted with each proposal package, as shown in Table D.1 of Annex D."

4	29	4.5.6.16	In first sentence, change "…by functional subsystem or drawing tree structure" to "…by functional subsystem, showing subsystem breakdown to the second level of detail."
4	30	4.5.6.17	In first sentence, change "…by functional subsystem or drawing tree structure" to "…by functional subsystem, showing subsystem breakdown to the second level of detail."
4	30	4.5.6.21 (new)	Add a subsection requiring reporting of propellant budget, including contingencies, for each mission phase.
5	30	5 (new)	Add a section for contractor deliverables, referencing Appendices D and E.
Section	Page	Paragraph	Change Required/Rationale
Annex B	33	B.1-B.3	In section title, change from (Informative) to (Normative). Change all "should"s to "shall"s.
Annex D	45-46	Table D.1	Add a line 4.5.1 "Mass Properties Control Plan (Preliminary)" and place an "x" in column 3 ("With submittal of all proposals"). On line 4.5.6.17, add an "x" to column 15. Add a line 4.5.6.21 "Fluid and Propellant Loads", and place an "x" in columns 1–6, 10–11, and 14-17. Delete column 19.
Annex E	48	Table E.1 (new)	Add a table to reference Data Item Descriptions that authorize changes to the deliverables of AIAA S-120-2006.

3. Vocabulary

There are no changes to this section—use AIAA S-120-2006 verbatim.

4. Requirements

4.1 Mass Properties Control

Use AIAA-S-120-2006 for all paragraphs, tables, and figures, except as noted below.

4.1.2.3 Program Schedules

A top-level program schedule showing major milestones and deliverables shall be referenced in the Mass Properties Control Plan (MPCP). The contractor shall derive major mass properties milestones and deliverables from the top-level schedule, and include that schedule in the MPCP.

4.1.3.2.3 Mass Growth Allowance and Depletion Schedule

The contractor shall include in the mass data an allowance for the expected mass growth resulting from lack of maturity in the current design data. Mass growth varies as a function of hardware type and its design maturity. The Mass Growth Allowance (MGA) shall be applied at the lowest design detail level reported in the mass properties database. Depletion of the MGA follows the design process; as the design and analyses of the hardware matures, the MGA depletes to reflect increased confidence in the predicted final mass. The contractor shall use Table 1, Mass Growth Allowance and Depletion Schedule, to determine MGA. The contracting officer may grant an exception to this requirement and approve the contractor's use of their own mass growth and depletion schedule in specific cases where the contractor is able to provide past program performance data that supports successful algorithm predictions of final mass with adequate margin. The contractor's past performance data will be evaluated by the contracting officer for applicability to the current program scope (e.g., mission category and type, mass and power class, first-generation design versus generational design with increased complexity or scope, or new technology insertion).

Table 1. Mass Growth Allowance and Depletion Schedule

Major category	Maturity Code	Design Maturity (Basis for Mass Determination)	Mass Growth Allowance (%)												
			Electrical/Electronic Components			Structure	Brackets, Clips, Hardware	Battery	Solar Array	Thermal Control	Mechanisms	Propulsion	Wire Harness	Instrumentation	ECLSS, Crew Systems
			0-5 kg	5-15 kg	>15 kg										
E	1	**Estimated** 1) An approximation based on rough sketches, parametric analysis, or undefined requirements, 2) A guess based on experience, 3) A value with unknown basis or pedigree.	30	25	20	25	30	25	30	25	25	25	60	60	23
	2	**Layout** 1) A calculation or approximation based on conceptual designs (equivalent to layout drawings), 2) Major modifications to existing hardware	25	20	15	15	20	15	20	20	15	15	30	30	15
	3	**Preliminary Design** 1) Calculations based on a new design after initial sizing but prior to final structural or thermal analysis, 2) Minor modification of existing hardware	20	15	10	10	15	10	10	15	10	10	25	25	10
C	4	**Released Design** 1) Calculations based on a design after final signoff and release for procurement or production, 2) Very minor modification of existing hardware, 3) Catalog value	10	5	5	5	6	5	5	5	5	5	10	10	6
A	5	**Existing Hardware** 1) Actual mass from another program, assuming that hardware will satisfy the requirements of the current program with no changes, 2) Values based on measured masses of qualification hardware	3	3	3	3	3	3	3	2	3	3	5	5	4
	6	**Actual Mass** Measured hardware	No mass growth allowance -- use appropriate measurement uncertainty values												
	7	**Customer Furnished Equipment or Specification Value**	Typically a "not-to-exceed" value is provided; however, contractor has the option to include MGA if justified												

Table 2. TPM-Mass Risk Assessment

Program Milestone	Recommended MGA	Recommended Predicted Dry Mass Margin	Basic Dry Mass Margin	
	(%)[1]	(%)[1]	(%)[2]	Grade
ATP	> 15 9 < MGA ≤ 15 ≤ 9	> 15 10 < Mass Margin ≤ 15 ≤ 10	> 30 19 < Mass Margin ≤ 30 ≤ 19	Green Yellow Red
PDR	> 12 8 < MGA ≤ 12 ≤ 8	> 9 5 < Mass Margin ≤ 9 ≤ 5	>21 13 < Mass Margin ≤ 21 ≤ 13	Green Yellow Red
CDR	> 7 4 < MGA ≤ 7 ≤ 4	> 5 3 < Mass Margin ≤ 5 ≤ 3	> 12 7 < Mass Margin ≤ 12 ≤ 7	Green Yellow Red
Drawing Release Complete	> 3 2 < MGA ≤ 3 ≤ 2	> 2 1 < Mass Margin ≤ 2 ≤ 1	> 5 3 < Mass Margin ≤ 5 ≤ 3	Green Yellow Red
Final	0	> 1	> 1	

1. The percentages of MGA and predicted dry margin in the above chart are defined as follows:
   MGA = predicted dry mass - basic dry mass
   % of MGA = (MGA/basic dry mass)x100
   dry mass limit = mass limit - propellant mass
   % of predicted dry mass margin = [(dry mass limit - predicted dry mass)/predicted dry mass] x 100
2. The basic dry mass margin is defined as:
   % of basic dry mass margin = [(dry mass limit - basic dry mass)/basic dry mass] x 100

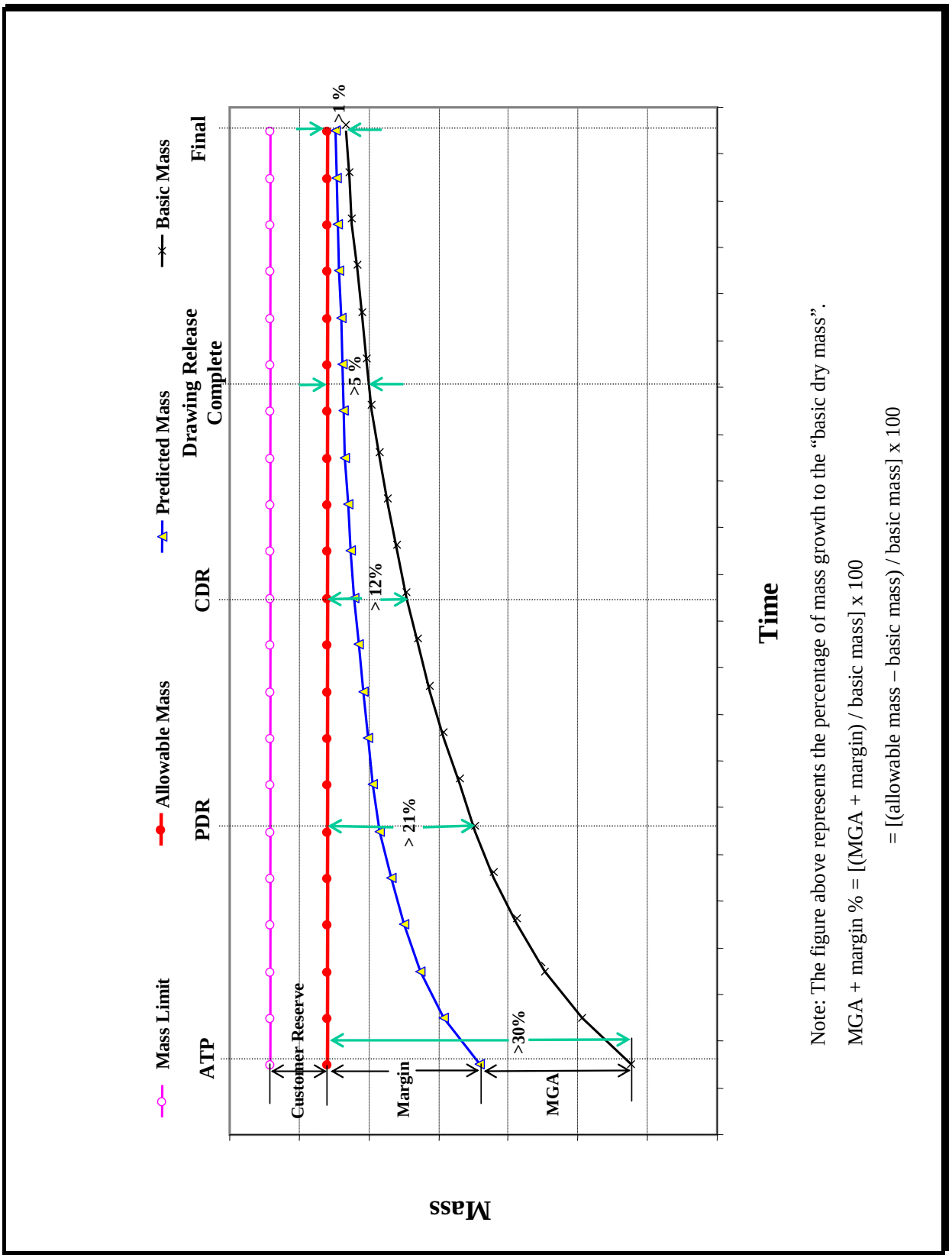
4.1.3.2.6.3 Explanation of Table 2 Color Coding

Table 2 represents the mass risk assessment derived by comparing the allowable dry mass to the basic dry mass at each major program phase. The MGA is based on a system-level average of the values in Table 1, and is shown for reference in Table 2. The basic dry mass margin, however, is historically based, and deviations from this baseline may be granted by the contracting officer where sufficient justification is provided by the contractor for lesser margin values. An example could be a generational design that follows a previously developed concept with capability or complexity enhancements within an established design envelope (heritage bus design with extensive use of off-the-shelf hardware).

Color code definitions:

- Green: at each specific design phase (program milestone), if the combination of MGA and predicted dry mass margin is greater than the percentages shown on the first line in the green shaded areas of Table 2, mass risks are considered to be minimal. No action is required other than monitoring the mass status.
- Yellow: if the combination of MGA and predicted dry mass margin is in the yellow shaded percentage ranges, the mass risk is medium. A risk-handling plan should be prepared, with particular attention paid to potential design changes that would adversely affect the margin.
- Red: if the combination of MGA and predicted dry mass margin is in the red shaded areas, there is a high mass risk, and an immediate mass audit, mass reduction effort, or risk mitigation process should be initiated.

The green dry mass margin listed in Table 2 shall be the minimum requirement, unless superseded by a value specified in the technical requirement document (TRD).



Note: The figure above represents the percentage of mass growth to the "basic dry mass".

MGA + margin % = [(MGA + margin) / basic mass] x 100

= [(allowable mass – basic mass) / basic mass] x 100

Figure 2. Example plot of mass versus time.

4.2 Analysis

Use AIAA-S-120-2006 for all paragraphs except as noted below.

4.2.2 Methods of Analysis

The primary methods of analysis are typically dictated by the program phase. During all program phases, from proposal to launch and operation, the contractor shall substantiate the mass properties model and MGA values by providing a maturity assessment of each subsystem and key component. This assessment shall be accomplished by defining the heritage for each space system detail using the categories provided in Table 1. The early phases of program acquisition and development from authorization to proceed (ATP) through system preliminary design review (PDR) are critical because historical data indicates half of the mass growth experienced on an average program occurs during this period. The primary reasons for this observed mass growth are:

- lack of design maturity information
- overly optimistic assessment of the hardware maturity
- requirements that are not fully defined or understood, or are not flowed down to the subsystem or unit levels

During the early phases of the program (concept studies and concept development), the space system mass model maturity assessment may be accomplished by using the technology readiness level (TRL) method identified in the Defense Acquisition Guidebook November 2007, or by defining the heritage for each detail of the flight hardware in the following categories: new, modified, or existing. When parametric scaling techniques are used, the contractor shall provide historical data to support these methods. For detailed mass properties analysis, the coordinate system reference shall be documented.

4.2.3.1 Mass Properties Parameter Requirements

The mass properties parameters required for analysis of space system components shall include mass, center of mass (CM), moments of inertia (MOI), and products of inertia (POI).

4.2.3.4 Heritage of Hardware

The contractor shall define the heritage (new, modified, and existing) of all space system flight hardware in the request for proposal (RFP) submittal and clearly indicate hardware designs that would be considered “new technology insertion.”

4.2.5.4.6 Breakup Analysis/Disposal

4.2.5.4.6.1 Breakup Analysis

A space system may malfunction from an anomalous ascent breakup; potential space system debris would be expected that may pose a threat to life and property. The contractor shall have the capability to provide accurate mass properties data for the debris of the space system when given specific configurations to track. In addition, hazardous materials may be released during breakup. The following data are required for the breakup analysis:

a. A detailed description of the major components and assemblies.

b. Mass, center of gravity, and dimension data of the major components and assemblies.

c. Ordnance device and explosive data including locations, types, part numbers, quantities and net explosive mass.

d. The amount of propellant mass from tanks.

e. The amount of the electrolyte solutions mass from battery cells.

f. The amount of ammonia mass from heat pipes.

4.2.5.4.6.2 Disposition

Mission analysis may require a plan to de-orbit or reposition a space system at the end of its operational life. The propellant required for de-orbiting or repositioning shall be included in the propellant budget.

4.3 Verification

Use AIAA-S-120-2006 for all paragraphs except as noted below.

4.3.4.4 Test Configuration

Use AIAA-S-120-2006 for all text in this section, except the first bullet shall read as follows:

The test article shall simulate the dry flight condition and be at least 90% complete by mass, excluding hazardous components or components not normally installed at the measurement site. Deviations from the flight condition should be commensurate with test objectives such that the test results are meaningful and measurement uncertainties are within expected ranges.

4.4 Mass Properties Data Management

There are no changes to this section; use AIAA S-120-2006 verbatim.

4.5 Documentation

Use AIAA-S-120-2006 for all paragraphs except as noted below.

4.5.1 Mass Properties Control Plan

A mass properties control plan in accordance with 4.1 shall be developed and documented by the contractor. The plan shall state the management program and procedures to be used for mass properties control, analysis, verification, and documentation of the space system. A preliminary mass properties control plan shall be submitted with each proposal package, as shown in Table D.1 of Appendix D.

4.5.6.16 Detailed Mass

Prepare a tabulation of the current space system detailed mass by functional subsystem, showing subsystem breakdown to the third level of detail. Show the following for each line of detail.

- Functional Code
- Description
- Basic Mass
- Predicted Mass
- Percent of Basic Mass in Each Category as Coded in Table 1
- MGA

4.5.6.17 Detailed Mass Properties

Prepare a tabulation of the current space system detailed mass properties by functional subsystem, showing subsystem breakdown to the third level of detail. Show the following for each line of detail.

- Functional Code
- Description
- Basic Mass
- Predicted Mass
- Center of Mass (X, Y, Z)
- Moment of Inertia (Ix, Iy, Iz)
- Product of Inertia (Ixy, Ixz, Iyz)

The contractor shall stipulate whether the values used to derive CM, MOI, and POI are derived from basic or predicted mass.

4.5.6.21 Fluid and Propellant Loads

For each fluid and propellant load reported, present a detailed summary of the fluid/propellant load budget. The budget shall specify the predicted mission fluid and/or propellant allocation required for each mission phase and include appropriate contingencies (for mission design, thruster performance, and mission execution) based on the program acquisition phase. Specify the source for the budget that describes the parameters and criteria used to substantiate the reported values.

5. Contractor Deliverables

Refer to Appendix D for a complete listing of contract deliverables and a submittal schedule and Appendix E for the applicable Data Item Description (DID).

Appendix A. Supplemental Information for Terms and Definitions

There are no changes to this Appendix—use AIAA S-120-2006 verbatim.

Appendix B. Functional Breakdown of Mass (Normative)

B.1 Scope

Space systems are comprised of subsystems that perform specific functions. Examples of two subsystems are structural support for equipment and electrical power. Useful subsystem information is generated when component masses are accumulated on a functional basis. The uses of functional subsystem mass include the tracking of functional mass during design for mass proposed for new vehicles, and the improvement of the database used for the refinement of mass-estimating methods. It is necessary to strive for consistency regarding which components comprise each subsystem if the objectives of subsystem mass estimation and evaluation are to be achieved. Consideration shall also be given to the configuration for which actual mass data will be obtained. The following sections provide guidelines for achieving this consistency.

B.2 Referenced Documents

JSC-23303 "Design Mass Properties, Guidelines and Formats for Aerospace Vehicles," dated March 1989, (NASA Johnson Space Center).

B.3 Requirements

B.3.1 Establishment of a Subsystem List

In accordance with Section B.1, wherein the functional basis is discussed, a list shall be established that names each of the subsystems comprising the space system. Since the term "space systems" is representative of a large variety of vehicles with a wide range of complexities, specifying a comprehensive subsystem list in this Appendix is not considered advisable. However, several subsystem lists are given in Tables B.1 through B.4, which are intended to serve as guides. Additional guidelines can be found in JSC 23303. The contractor shall develop a subsystem list suitable for the space system being developed. This contractor's list shall contain subsystems in at least as much detail as represented in Tables B.1 through B.4.

B.3.2 Subsystem Breakdown

B.3.2.1 Second Level of Detail

Each subsystem's total mass shall be broken down to a second level of detail. This second level of detail shall be constructed to provide useful information for mass estimation and evaluation. For example, useful information is provided when a satellite electrical power subsystem is broken down into components of solar array, batteries, and power conditioning. Representative subsystem breakdowns to a second level of detail are shown in Tables B.1 through B.4. The contractor shall establish the applicable second-level mass breakdown and it shall be at least to the level of detail represented in Tables B.1 through B.4.

B.3.2.2 Third Level of Detail

The second level of detail shall be further broken down to a third level where applicable to facilitate a more detailed evaluation of mass and mass properties. Examples of this are shown in Tables B.1 through B.4. The third level, also known as the "unit level," provides valuable information on location of individual units or subassemblies.

B.3.2.3 Subsequent Levels of Detail

A breakdown of the third level of detail to lower levels may be useful for evaluation purposes. The Contract Data Requirements List (CDRL), incorporated into the contract, may require the contractor's subsystem list, the second- and third-level-of-detail list, and any subsequent level-of-detail lists, be prepared for review and approval by the contracting officer.

B.3.3 Functional Coding

The contractor shall develop a functional code that is consistent with the subsystem list and level of detail lists described in Sections B.3.1 and B.3.2 of this Appendix. The code format is not specified. As masses are determined, they shall be coded and accumulated by the codes.

B.3.3.1 Ambiguities

In the process of coding items to a function, ambiguities are likely to occur. For example, a solid propellant motor case may have two functions: propulsion and basic structure. A cylindrical portion of a motor case may be partially designed by the loads produced by the payload the launch vehicle carries and partially designed by the case internal pressure. The domes are designed by the internal pressure and the motor case skirts are designed by axial and bending loads. Another example would be the structure used to support the solar cells on a deployable solar array panel. Arguments can be made for either a structure or electrical power functional code.

B.3.3.2 Resolution of Ambiguities

For those items that have more than one function, the contractor shall code them to the primary function according to Table B.5. If the choice is not obvious, the contractor may choose between the two closest candidate categories. When decisions are made for items constituting at least 10% of the subsystem mass, the contractor shall maintain descriptive titles in the mass properties records of the space system. This permits the transfer of these items from one function to another at the discretion of the contracting officer.

Tables B.1 through B.5

There are no changes to these tables—use AIAA S-120-2006 verbatim.

Appendix C. Space System Design Features

There are no changes to this Appendix—use AIAA S-120-2006 verbatim.

Appendix D. Document Content and Submittal Schedule

D.1 Schedule of Submittals

There are no changes to this paragraph—use AIAA S-120-2006 verbatim.

D.2 Distribution

There are no changes to this paragraph —use AIAA S-120-2006 verbatim.

Table D.1. Document Content and Submittal Schedule.

PROGRAM PHASE		PRE-SYSTEMS ACQUISITION			SYSTEMS ACQUISITION					
		PRE-KDP-A	PHASE A		PHASE B					
		CONCEPT STUDIES	CONCEPT DEVELOPMENT		PRELIMINARY DESIGN					
Column No.		1	2	3	4	5	6	7	8	9
SCHEDULE OF SUBMITTALS		Monthly for studies < 2 months; At first of each month for studies > 2months; Semiannually for studies > 1 year or more; At completion of all studies;	Monthly for studies < 2 months; At first of each month for studies > 2 months; Semiannually for studies > 1 year; At completion of all studies; At major design reviews;	With submittal of all proposals	At Authorization To Proceed (within 30 days of ATP)	Monthly Reports - at first of each month between ATP and PDR	At PDR	Mass Properties Control Plan - within 60 days after ATP	Verification Plan - submittal with PDR package	Contract Change Proposal - with each contract change proposal
DOCUMENT TYPES		Status Report	Status Report		Status Report			Procedural		Misc.
Section	DOCUMENT ELEMENT									
4.5.6.1	Title Page	x	x	x	x	x	x	x	x	x
4.5.6.2	Table of Contents	x	x	x	x	x	x	x	x	x
4.5.6.3	Introduction	x	x	x	x	x	x	x	x	x
4.5.6.4	Mass Properties Summary	x	x	x	x	x	x			x
4.5.6.5	Mass Change Analysis	x	x		x	x	x			x
4.5.6.6	Mass Change Summary by Change Code				x	x	x			x
4.5.6.7	Pending and Potential Changes	x	x	x	x	x	x			x
4.5.6.8	Coordinate Axes and SV Configurations	x	x	x	x	x	x			x
4.5.6.9	Sequenced Mass Properties			x	x	x	x			
4.5.6.10	Space Vehicle Movable Objects			x	x	x	x			
4.5.6.11	Mission Critical Mass Properties	x	x	x	x	x	x			
4.5.6.12	Uncertainties						x			
4.5.6.14	Mass Growth Allowance & Depletion Schedule	x	x	x	x	x	x	x		
4.5.6.15	Space Vehicle Design Features	x	x	x	x		x			
4.5.6.16	Detail Mass	x	x	x	x	x	x			
4.5.6.17	Detailed Mass Properties				x		x			
4.5.6.18	Definitions and Acronyms	x	x	x	x	x	x	x	x	
4.5.6.19	References	x	x	x	x	x	x	x	x	
4.5.6.21	Fluid and Propellant Loads	x	x	x	x	x	x			
4.5.1	Mass Properties Control Plan (Preliminary)			x						
4.5.1	Mass Properties Control Plan							x		
4.5.2	Verification Plan								x	
4.5.3	Test Procedure									
4.5.4	Test Completion Report									

Table D.1. Document Content and Submittal Schedule (continuation)

PROGRAM PHASE		SYSTEMS ACQUISITION								
		PHASE C				PHASE D				
		COMPLETE DESIGN				BUILD & OPERATIONS				
Column No.		10	11	12	13	14	15	16	17	18
SCHEDULE OF SUBMITTALS		Monthly Reports - at first of each month between PDR and CDR	AT CDR	Verification Plan Updated - submittal with CDR package	Contract Change Proposal - with each contract change proposal	Quarterly Reports - at first of each quarter between CDR and Launch	Final Mass Properties Testing - 14 days after test	At Pre-Ship Readiness Review	As-launched report within 14 days after launch	Test Procedures - 60 days in advance of the scheduled test
DOCUMENT TYPES		Status Report		Procedural	Misc.	Status Report				Miscellaneous
Section	DOCUMENT ELEMENT									
4.5.6.1	Title Page	x	x	x	x	x	x	x	x	x
4.5.6.2	Table of Contents	x	x	x	x	x	x	x	x	x
4.5.6.3	Introduction	x	x	x	x	x	x	x	x	x
4.5.6.4	Mass Properties Summary	x	x			x	x	x	x	
4.5.6.5	Mass Change Analysis	x	x			x	x	x	x	
4.5.6.6	Mass Change Summary by Change Code	x	x			x	x	x	x	
4.5.6.7	Pending and Potential Changes	x	x			x	x	x	x	
4.5.6.8	Coordinate Axes and SV Configurations	x	x	x		x	x	x	x	x
4.5.6.9	Sequenced Mass Properties	x	x			x	x	x	x	
4.5.6.10	Space Vehicle Movable Objects	x	x			x	x	x	x	
4.5.6.11	Mission Critical Mass Properties	x	x			x	x	x	x	x
4.5.6.12	Uncertainties		x				x	x	x	
4.5.6.14	Mass Growth Allowance & Depletion Schedule	x	x			x	x	x	x	
4.5.6.15	Space Vehicle Design Features	x	x			x	x	x	x	
4.5.6.16	Detail Mass	x	x			x	x	x	x	
4.5.6.17	Detailed Mass Properties		x			x	x	x	x	
4.5.6.18	Definitions and Acronyms	x	x	x		x	x	x	x	x
4.5.6.19	References	x	x	x		x	x	x	x	x
4.5.6.21	Fluid and Propellant Loads	x	x			x	x	x	x	
4.5.1	Mass Properties Control Plan (Preliminary)									
4.5.1	Mass Properties Control Plan									
4.5.2	Verification Plan			x						
4.5.3	Test Procedure									x
4.5.4	Test Completion Report						x			

Appendix E. Data Item Descriptions

The following table indicates which portions of the AIAA Standard have been tailored along with the DID which authorizes the tailoring.

Section No.	Data Requirement Title	Applicable DID No.
4.1	Mass Properties Control	DI GDRQ 81227
4.2	Mass Properties Analysis	TBD
4.3	Mass Properties Verification	DI GDRQ 81228
4.5	Mass Properties Documentation	DI GDRQ 81229
Appendix D	Example Document Content	DI-S-3599/S-139-1

DATA ITEM DESCRIPTION

Form Approved
OMB NO. 0704-0188

1. TITLE	2. IDENTIFICATION NUMBER
Generic Mass Properties Analysis Plan	

3. DESCRIPTION/PURPOSE

This section describes the contractor's mass properties analysis plan for satisfying the applicable task requirements of AIAA S-120-2006, section 4.2, as tailored by TOR-2008(8583)-7560 (hereafter referred to as the "Tailored AIAA Standard").

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE
Draft			

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for the work task described by 4.2 of the Tailored AIAA Standard.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions, shall be as specified in the contract.

10.2 Content and Format. This section shall be prepared in accordance with the content and format instructions stated in the Tailored AIAA Standard including the following sections in the TOR-2008(8583)-7560:

a) 4.2.2: add technology maturity assessment via the technology readiness level (TRL) method identified in the DoD Acquisition Guidebook as a method of categorizing flight hardware as new, modified, or existing.

b) 4.2.3.4: add **Heritage of Hardware** : "The contractor shall define the heritage (new, modified, existing) of all space vehicle flight hardware in the Request for Proposal (RFP) submittal, and shall clearly indicate hardware designs that would be considered new technology insertion."

c) 4.2.5.4.6 Breakup Analysis/Disposal: expand to include detailed information on components to be considered in the analysis.

11. DISTRIBUTION STATEMENT

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DATA ITEM DESCRIPTION

Form Approved
OMB NO. 0704-0188

1. TITLE
Generic Mass Properties Document Content and Submittal Schedule

2. IDENTIFICATION NUMBER

3. DESCRIPTION/PURPOSE
3.1 This section describes the contractor's mass properties document content and submittal schedule for satisfying the task requirements of AIAA S-120-2006, Annex Table D.1, as tailored by TOR-2008(8583)-7560 (hereafter referred to as the "Tailored AIAA Standard").

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE
Draft			

7. APPLICATION/INTERRELATIONSHIP
7.1 This DID contains the format and content preparation instructions for the work task described by Table D.1 of the Tailored AIAA Standard.

7.2 This report shall state the schedule to be used for mass properties data submittal.

7.3 This DID supersedes all previous revisions of DI-S-3599/S-139-1.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS
10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions, shall be as specified in the contract.

10.2 Content and Format. This section shall be prepared in accordance with the content and format instructions stated in Table D.1 of the Tailored AIAA Standard including the following from TOR-2008(8583)-7560:

a) add a preliminary mass properties control plan for each proposal submittal

b) add propellant analysis

c) add detailed mass properties report for each proposal submittal

11. DISTRIBUTION STATEMENT

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DATA ITEM DESCRIPTION

Form Approved
OMB NO. 0704-0188

1. TITLE	2. IDENTIFICATION NUMBER
Generic Mass Properties Documentation Plan	

3. DESCRIPTION/PURPOSE

3.1 This section describes the contractor's mass properties documentation plan for satisfying the task requirements of AIAA S-120-2006, section 4.5, as tailored by TOR-2008(8583)-7560 (hereafter referred to as the "Tailored AIAA Standard").

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE
Draft			

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for the work task described by 4.5 of the Tailored AIAA Standard.

7.2 This report shall state the plan to be used for mass properties documentation.

7.3 This DID supersedes all previous revisions of DI-GDRQ-81229.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions, shall be as specified in the contract.

10.2 Content and Format. This section shall be prepared in accordance with the content and format instructions stated in 4.5 of the Tailored AIAA Standard, including the following sections in TOR-2008(8583)-7560:

a) 4.4.1, adding a requirement for a preliminary mass properties control plan.

b) 4.5.6.16 & 17, which permits functional breakdown of mass only.

c) 4.5.6.21, adding the requirement to report propellant budget.

11. DISTRIBUTION STATEMENT

DATA ITEM DESCRIPTION

Form Approved
OMB NO. 0704-0188

1. TITLE
Generic Mass Properties Verification Plan

2. IDENTIFICATION NUMBER

3. DESCRIPTION/PURPOSE
3.1 This section describes the contractor's mass properties verification plan for satisfying the task requirements of AIAA S-120-2006, section 4.3, as tailored by TOR-2008(8583)-7560 (hereafter referred to as the "Tailored AIAA Standard").

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE
Draft			

7. APPLICATION/INTERRELATIONSHIP
7.1 This DID contains the format and content preparation instructions for the work task described by 4.3 of the Tailored AIAA Standard.

7.2 This report shall state the plan to be used for mass properties verification.

7.3 This DID supersedes all previous revisions of DI-GDRQ-81228.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS
10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions, shall be as specified in the contract.

10.2 Content and Format. This section shall be prepared in accordance with the content and format instructions stated in 4.3 of the Tailored AIAA Standard, including the following section in TOR-2008(8583)-7560: 4.3.4.4, specifying that the test article shall simulate the flight article 90% by mass.

11. DISTRIBUTION STATEMENT

DATA ITEM DESCRIPTION

Form Approved
OMB NO. 0704-0188

1. TITLE
Generic Mass Properties Control Plan

2. IDENTIFICATION NUMBER

3. DESCRIPTION/PURPOSE
3.1 This section describes the contractor's mass properties control plan for satisfying the task requirements of AIAA S-120-2006, section 4.1, as tailored by TOR-2008(8583)-7560 (hereafter referred to as the "Tailored AIAA Standard").

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE
Draft			

7. APPLICATION/INTERRELATIONSHIP
7.1 The DID contains the format and content preparation instructions for the work task described by 4.1 of the Tailored AIAA Standard.

7.2 This report shall state the plan to be used for control of the mass properties of a space system.

7.3 This DID supersedes all previous revisions of DI-GDRQ-81227

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS
10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions, shall be as specified in the contract.

10.2 Content and Format. This section shall be prepared in accordance with the content and format instructions stated in the Tailored AIAA Standard including the following sections in the TOR-2008(8583)-7560:

a) 4.1.2.3, requirement for generating a mass properties milestone/delivery schedule based on a top-level program schedule.

b) Section 4.1.3.2.3 and Table 1, "Mass Growth Allowance and Depletion Schedule"

c) Table 2, TPM – mass risk assessment including the instructions and explanation of Table 2 Color Coding in section 4.1.3.2.6.3

11. DISTRIBUTION STATEMENT

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SMC Standard Improvement Proposal

INSTRUCTIONS

1. Complete blocks 1 through 7. All blocks must be completed.
2. Send to the Preparing Activity specified in block 8.

NOTE: Do not be used to request copies of documents, or to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. Comments submitted on this form do not constitute a commitment by the Preparing Activity to implement the suggestion; the Preparing Authority will coordinate a review of the comment and provide disposition to the comment submitter specified in Block 6.

SMC STANDARD CHANGE RECOMMENDATION:	**1. Document Number**	**2. Document Date**
3. Document Title		

4. Nature of Change
(Identify paragraph number; include proposed revision language and supporting data. Attach extra sheets as needed.)

5. Reason for Recommendation

6. Submitter Information

a. Name	**b. Organization**
c. Address	**d. Telephone**
e. E-mail address	**7. Date Submitted**

8. Preparing Activity

Space and Missile Systems Center
AIR FORCE SPACE COMMAND
483 N. Aviation Blvd.
El Segundo, CA 91245
Attention: SMC/EAE