Volume I, Section 1

1 INTRODUCTION

{A}

This section contains the following topics:

1.1 Purpose
1.2 Overview
1.3 Scope, Precedence, and Limitations
1.4 How to Use the Documents
1.5 Standards Database (TBD)

1.1 PURPOSE

{A}

This document provides specific user information to ensure proper integration of the man-system interface requirements with those of other aerospace disciplines. These man-system interface requirements apply to launch, entry, on-orbit, and extraterrestrial space environments. This document is intended for use by design engineers, systems engineers, maintainability engineers, operations analysts, human factors specialists, and others engaged in the definition and development of manned space programs.

Concise design considerations, design requirements and design examples are provided. Requirements specified herein are applicable to all U.S. manned-space flight programs.

This document replaces earlier NASA field center human engineering standards documents (e.g., MSFC-STD-512A, Man/System Requirements for Weightless Environments; JSC-07387B, Crew Station Specifications). This document also incorporates human engineering standards and guidelines from many other NASA, military, and commercial human engineering standards applicable to the space environments described above.

The document volumes have been extracted from a relational data base.

(Refer to Paragraph 1.3, Scope, Precedence, and Limitations, for description of the documents.)

1.2 OVERVIEW

{A}

The MSIS was created to provide a single, comprehensive document defining all generic requirements for space facilities and related equipment which directly interface with crewmembers. The depth and breadth with which the MSIS covers the field of human factors as related to the space environment is easily seen in the following overview of the documents contents.

The chapter on Anthropometry and Biomechanics presents quantitative information about human body size, posture, movements, surface area, and mass projected to the year 2000.

The chapter on Human Performance Capabilities documents the significant ways the performance capabilities of humans may change when they go into space.

The chapter on Natural and Induced Environments documents the conditions to which a crewmember will be exposed during space flight. These include atmospheric composition, microgravity and acceleration effects, and acceptable noise, vibrations, radiation, and thermal levels.

The chapter on Crew Safety deals with general safety concerns as they relate directly to the crewmember.

The chapter on Health Management discusses the measures that must be taken to maintain the health of the crewmembers.

The chapter on Architecture discusses the placement, arrangement, and grouping of compartments and crew stations in space modules, including design data for items which integrate these various areas. These include traffic flow and translation paths hatches and doors, location and orientation cures, and mobility aids and restraints.

The chapter on Workstations covers workstation design, including layout, controls, displays, labeling and coding, and user/computer interface.

The chapter on Activity Centers discusses design and layout requirements for off-duty crew stations in the space module. These include facilities for personal hygiene, body waste management, meetings, recreation, microgravity countermeasures, medical treatment, laundry, trash management, and storage facilities, also crew quarters, galley, and wardroom.

The chapter on Hardware and Equipment provides information concerning tools, drawers and racks, closures, mounting hardware, handles and grasp areas, restraints, mobility aids, fasteners, connectors, windows, packaging, crew personal equipment, and cable management.

The chapter entitled Design for Maintainability covers general equipment design requirements; physical access; visual access; removal, replacement, and modularity requirements fault and isolation requirements; test point design; and requirements for a maintenance data management system.

The chapter on Facility Management covers housekeeping, inventory control, and information management.

The chapter on General EVA Information establishes guidelines for extravehicular activity which is defined as any activity performed by a pressure-suited crewmember in unpressurized or space environments.

Although written for application to the space environment, much of the information contained in the MSIS has obvious applicability to human interface/engineering problems encountered in terrestrial environments. Use of the MSIS in man-systems types of applications in one-g is encouraged as long as the user recognized the instances in which special consideration has been given to the micro-g environment in the document.

The MSIS will be kept current through an annual review process in which all users of the documents are invited to participate.

1.3 SCOPE, PRECEDENCE, AND LIMITATIONS

{A}

a. Document Scope - The overall documentation is contained in several volumes (currently four). Each document has a purpose, and each has been assembled from the data contained in Volume I. A videotape is also available as an adjunct to this documentation (see figure 1.3-1).

The title and scope of each volume are given below:

NASA-STD-3000, Volume I - Man-Systems Integration Standards

This document contains man-systems integration design considerations, design requirements, and example design solutions for development of manned space systems. This is a NASA-level standards document which is applicable to all manned space programs and is not limited to any specific NASA, military, or commercial program.

NASA-STD-3000, Volume II - Man-Systems Integration Standards - Appendices

This volume contains the appendices which pertain to the MSIS, and is organized as follows:

Appendix A Bibliography

Appendix B Paragraph References

Appendix C Glossary

Appendix D Abbreviations and Acronym

Appendix E Units of Measure and Conversion Factors

Appendix F Unresolved Data Problems and Issues (TBD)

Appendix G Acceleration Regime Applicability

Appendix H Videotape Users Guide

Appendix I Standards Database (TBD)

Appendix J Keywords

Appendix K MSIS Recipients Listing

(Refer to Paragraph 1.4.3, Appendices, for description of these appendices.)

Figure 1.3-1 MSIS Documents

Figure 1.3-1 MSIS Documents

NASA-STD-3000, Volume III, Man-Systems Integration Standards - Design Handbook

This volume, is a condensed field guide of pertinent quantitative data extracted from Volume 1.

SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T)

This document serves as the International Space Station Alpha (ISSA) program contractually binding man systems integration design requirements. The data in this document are a subset of the data found in Volume I and defines the firm requirements which are pertinent to the ISSA program only.

NASA-STD-3000, Volume V - STS Man-Tended Payload Man-Systems Integration Standards

This volume was created to document all the man-systems integration design requirements for the development of man-tended payloads to be serviced by the Space Transportation System (STS) Orbiter Vehicle. Data deemed pertinent to the STS program has been incorporated into existing STS documentation. It is not anticipated that an STS Man-Tended Payload Man-Systems Integration Standard will ever be published.

NASA-STD-3000, Volume VI - Assured Crew Return Vehicle Man-Systems Integration Standards

This volume was created to document all the man-systems integration design requirements for the development of the assured crew return vehicle. All requirements in this volume deemed to be pertinent to the International Space Station Alpha (ISSA) program have been incorporated in SSP 50005. No further update of this volume is anticipated.

(Subsequent volumes of NASA-STD-3000 will be developed as needed for future manned space programs or projects.)

b. Precedence - Unless otherwise specified, the man-systems integration standards in the requirements subsections take precedence over the provisions in other documents referenced by the system specifications.

In many topical sections, cross references are cited that refer the user from an IVA (Intravehicular Activity) topical section to a related EVA (Extravehicular Activity) topical section, and vice versa. There will be some cases where IVA equipment and facilities will be used in an EVA mode of operation during a contingency situation, e.g., passageways. Where the reader must interpret requirements, that apply to both EVA and IVA, it is important to understand that a section applying to an EVA requirement is more stringent. EVA requirements should not be compromised by using IVA standards for EVA equipment or the reverse, i.e., over-designing IVA equipment by backlashing EVA requirements on IVA equipment.

c. Limitations - Applicable sections of reference documents cited in the Requirements subsections are considered contractually binding as well. Those given in the Introduction, Design Considerations, and Example Design Solutions subsections should be considered reference material and, therefore, not contractually binding unless specified by the contracting program.

1.4 HOW TO USE THE DOCUMENTS

{A }

1.4.1 Generic Topical Organization

{A}

A generic organization has been adopted for most topics. There are generally four generic subsections for each topic:

- Introduction

- Design Considerations

- Design Requirements

- Example Design Solutions

The content of each of these four generic subsections is shown in Figure 1.4.1-1 and described below.

The INTRODUCTION subsection provides a synopsis of the scope of topical material covered in the section. The reader is referred to other sections where related material can be found.

The DESIGN CONSIDERATIONS subsection provides background material that helps the user understand the rationale behind the requirements. This subsection may contain discussions of the environments pertinent to the topic and other tutorial information. This is where guidelines, recommendations and other nonbinding provisions (the shoulds) are given. The words design considerations appear in most of these paragraph titles.

The DESIGN REQUIREMENTS subsection provides the firm, contractually binding standards, requirements, and criteria (the shalls). These subsections are highlighted by using a sans serif-type font in the paragraph title, and using an italics font in the text.

The EXAMPLE DESIGN SOLUTIONS subsection is used where appropriate to illustrate and describe typical examples of how the requirements have been implemented in prior manned spacecraft.

1.4.2 Locating Data for a Specific Topic

{A}

In this document, there are several ways to locate information for a specific topic or topical area (see Figure 1.4.2-1):

a. Use the TABLE OF CONTENTS. The TOP LEVEL TABLE OF CONTENTS is found at the front of Volume 1. This top level table of contents shows only the first 2 levels of indenture of the 14 chapters.

b. Use the TAB DIVIDERS to go directly to the chapters. The detailed table of contents for the chapter is located behind the tab divider.

c. Use the KEYWORDS INDEX found in Appendix J of Volume II - The alphabetized keyword list in this appendix lists the paragraph numbers and titles that contain data applicable to each of the keywords.

d. Follow the (Refer to Paragraph.....) statements to find other related data.

Figure 1.4.1-1 Almost Every Topical Subsection Utilizes "Generic" Organization

Figure 1.4.1-1. Almost Every Topical Subsection Utilizes "Generic" Organization Structure

Figure 1.4.2-1 How to Locate Topical Data in MSIS Documents

1.4.3 Appendices

{A}

1.4.3.1 References

{A}

The references used as the basis for the data contained in the database and documents are listed in Appendices A and B of Volume II:

a. APPENDIX A - BIBLIOGRAPHY

1. This is the full bibliography of references used or examined during the development of the data.

2. References that were cited are listed in boldface type font.

b. APPENDIX B - PARAGRAPH REFERENCES

1. This appendix lists the paragraph numbers in numerical sequence.

2. Each reference used as a basis for the data in the paragraph is cited by the reference number.

3. For each reference, the specific location where data were obtained (section, paragraph, and/or page number) is cited.

1.4.3.2 Glossary, Acronyms, Units of Measure, and Conversion Factors

{A}

Definitions will be found in one of the following appendices in Volume II:

APPENDIX C - GLOSSARY

APPENDIX D - ABBREVIATIONS AND ACRONYMS

APPENDIX E - UNITS OF MEASURE AND CONVERSION FACTORS

1.4.3.3 Acceleration Regimes - Applicability

{A}

One of the unique features of the database is that every paragraph has been coded as the applicable acceleration regimes. At the beginning of each paragraph, a notation is made in brackets { } with one or two of the following codes:

O = Orbital = the microgravity acceleration environments encountered in orbital and very low acceleration transorbital operations.

L = Launch/Entry = the multi-G launch, entry, and abort acceleration environments.

P = Planetary = the G-loads encountered on the moon and Mars. Long-term, low-level accelerations encountered in some transorbital flight operations may be applicable. An artificial gravity system may also fall into this acceleration regime.

A = All = this regime includes all of the above plus one-g acceleration environment.

Appendix G in Volume II contains a matrix that lists all of the paragraphs and identifies which of these acceleration regimes are applicable. This list will be very useful when identifying man-system integration requirements for new space systems that have peculiar acceleration environments.

1.4.3.4 Unresolved Data Problems and Issues (TBD)

1.4.3.5 Videotape Users Guide

{A}

A videotape has been made that illustrates the various man-systems integration problems that have been identified during Gemini, Apollo, Skylab, and Shuttle manned space flights. The videotape contains scenes from on-orbit crew activities.

The videotape has a clock and notations of paragraph numbers from this document that correlate to the topics illustrated in the video.

A videotape users guide is provided in Appendix H of Volume II that lists the time, paragraph numbers, and paragraph titles.

1.4.4 Document Acquisition and Maintenance

{A}

Copies of this document and the videotape can be obtained in one of two ways:

a. This document can be reproduced without any restrictions.

b. Original copies of the document and videotape can be obtained from the following source:

MSIS Custodian/SP3

NASA - Johnson Space Center

Houston, TX 77058

Users are encouraged to use the Recommendations and Comments form found at the back of each document to bring to the MSIS Custodians attention any discrepancies, problems, or issues related to the use of the documentation, videotape, or database.

1.5 STANDARDS DATABASE (TBD)

{A}